35757

WORK PLAN
SCOPE OF WORK

PHASE III REMEDIAL INVESTIGATION/
FEASIBILITY STUDY

BALLY ENGINEERED STRUCTURES SITE
BALLY, PENNSYLVANIA

REMCOR

WORK PLAN

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BALLY ENGINEERED STRUCTURES SITE
BALLY, PENNSYLVANIA

PREPARED FOR

BALLY ENGINEERED STRUCTURES, INC.

SEPTEMBER 23, 1987

PROJECT NO. 87313

REMCOR, INC.
PITTSBURGH, PENNSYLVANIA

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1.0 INTRODUCTION

This document presents a final Work Plan Scope of Work (SOW) for a Phase III Remedial Investigation/Feasibility Study (RI/FS) at the Bally Engineered Structures (BES) site in Bally, Berks County, Pennsylvania. A separate Field Sampling and Analysis Plan (FSAP) and site-specific Health and Safety Plan have also been developed to implement the SOW. The RI/FS SOW has been prepared by Remcor, Inc. (Remcor), Pittsburgh, Pennsylvania on behalf of BES in accordance with the requirements established in the final Administrative Order by Consent (ACO) between the U.S. Environmental Protection Agency (EPA) and BES dated January 28, 1987. This document addresses all comments received from EPA Region III through July 27, 1987. All documentation supporting this work plan is identified in the attached reference section.

1.1 SITE DESCRIPTION

The BES site consists of an active manufacturing facility situated on a tract of approximately 19 acres in the Borough of Bally, about 12 miles south of Allentown on Route 100. Figure 1-1 provides a general site location map.

BES has operated the facility since 1972 and is engaged in the construction of insulated structures and structural panels. BES's predecessor, Bally Case and Cooler Company (BCC), had conducted manufacturing activities at the site since the 1930s and was the original owner of the facility.

In 1982, the presence of elevated concentrations of chlorinated volatile organics in one of the Borough's municipal wells (Well No. 3) focused attention on users of industrial solvents in the area. A survey conducted by the Pennsylvania Department of Environmental Resources (PADER) in 1983 (PADER, March 28, 1983) suggested the BES site as a potential source of contamination. Subsequent to a meeting in 1984 between BES and PADER, Environmental Resources Management, Inc. (ERM) was retained by BES to evaluate existing data and to perform an initial RI (Phase I and Phase II studies) to evaluate potential sources of contamination to Bally Well No. 3.

ERM's report submitted in October 1986 (Funk and Smith, October 27, 1986) suggested that the BES site was the primary source of ground water contamination on the plant property. The report also concluded that the contamination extends north and northeast of the plant, toward Bally Municipal Well Nos. 3 and 1 (Figure 1-1). Other industrial and residential ground water users are located within the Borough, northeast of the BES plant. Predominant among the industrial users are the Bally Ribbon Company and the Great American Knitting Company, also shown in Figure 1-1.

Bally Municipal Well No. 3 was removed from the municipal supply system in 1982 as a result of the presence of volatile organics, most notably 1,1,1-trichloroethane (TCA) and trichloroethylene (TCE), both commonly used industrial degreasers. The ERM report concluded that high volume pumpage (approximately 300 gallons per minute [gpm]) of Well No. 3 from 1979 through 1982 served to draw volatile organic contaminants from the BES site toward the well, capturing contaminants that might otherwise have found their way into Bally Well No. 1 or other local industrial or residential wells. Although Well No. 3 was pumped to waste at a low rate from 1982 until March 12, 1987, its influence appears to be decreasing as levels of volatile organics in the other wells in the vicinity have been increasing. The increased contaminant levels suggest the need for remedial action at this time to counteract the further spread of contamination in the ground water system.

In consideration of the above, the current RI/FS SOW addresses characterization and remediation of ground water contamination. The primary objectives of the RI/FS are to delineate the source of ground water contamination at the BES facility, to characterize the hydrogeologic setting in sufficient detail to design an effective ground water cleanup program, and to provide a conceptual design of the remedial action to be implemented at this site. In a separate action, BES has agreed to establish wellhead treatment at Well No. 3 so that this well can be used as the primary alternative water supply for the Borough. Implementation of pumping and treatment will be concurrent with performance of the RI/FS and will be considered in evaluating public health and environmental concerns and in defining remedial alternatives.

This Phase III study is based, in part, on the results of the ERM Phase II work. The EPA has accepted the ERM data, subject to qualifications contained in its letter to BES, dated January 23, 1987 and the attached review by Vitale, et al. (January 8, 1987), and Orient and Evans (January 23, 1987).

1.2 WORK PLAN ORGANIZATION

Chapter 2.0 (Summary of Existing Data) provides a synopsis of the history and current status of facility operations, as well as of the Bally municipal wells, and summarizes investigations undertaken to date. Pertinent elements of the local environmental setting are discussed. The proposed wellhead treatment scheme at Well No. 3 is detailed. The approach to development of an assessment of public health and environmental concerns is stated.

Chapter 3.0 (Scoping of the RI/FS) discusses remedial action objectives from the perspective of public health and environmental concerns and Applicable, or Relevant and Appropriate Regulations (ARARs). Existing data are reviewed to determine additional data needs. A preliminary development of remedial actions is provided as a basis for scoping of the RI data needs.

Chapter 4.0 presents the actual statement of work for the 14 tasks to be performed in the RI/FS, and Chapter 5.0 outlines administrative requirements relative to project organization, management, and schedule.

2.0 SUMMARY OF EXISTING DATA

The purpose of this chapter is to summarize current knowledge relative to ground water contamination at the BES site, and its occurrence in the aquifer. A description of the activities that may have given rise to the current levels of contamination is provided as a basis for the site characterization described in Chapter 4.0.

Background is also provided relative to ground water use in the site area. Current data in this regard are important relative to understanding the potential rate and direction of future contaminant movement; historic data provide some insight in the current distribution of contaminants within the aquifer. A proposed wellhead treatment scheme for Well No. 3 is discussed. This chapter also provides a summary of the nature and extent of ground water contamination, based on the ERM Phase II report (Funk and Smith, October 27, 1986) and concludes with a preliminary assessment of public health and environmental concerns.

2.1 SITE HISTORY

2.1.1 BES Plant Facility

2.1.1.1 Overview

Initial manufacturing operations at the Bally plant site began in the 1930s with the production of high-quality wooden cabinets and cedar chests. Cabinet production continued until the 1940s when the plant was commissioned by the government to assist in the war effort.

In the 1950s, BCC turned to the manufacture of continuous-line, insulated meat display cases. The outer shell of these display cases was provided with a porcelain finish, and BCC also became a major supplier of porcelain panels for use as building facades.

The insulation used in the meat display cases during the 1950s was conventional fiberglass batting. In the late 1950s, however, BCC began experimenting with the use of urethane foam insulation to replace the batting. Actual use of urethane foam in the production process did not begin until the early to mid-1960s. Manufacture of the meat display cases was discontinued about 1969, and the production capability of the plant was fully dedicated to the manufacture of insulated panels.

BCC remained privately held until 1972, when it was purchased by the Sunbeam Corporation. BCC became a subsidiary of Allegheny International, Inc. (AI) with AI's acquisition of Sunbeam in 1982. BCC was renamed Bally Engineered Structures, Inc. in 1984, in response to the increased emphasis on the manufacture of insulated panels and product diversification.

2.1.1.2 Use of Hazardous Materials

Hazardous chemicals have been used at the Bally plant in two general areas since the 1950s:

- Pickling acids were used to prepare the surface of the metal shells for the display cases to receive the porcelain coatings.
- Degreasing agents were used to clean metal surfaces to ensure a good bond with urethane foam insulation, as well as to degrease small metal parts used in interlocking the insulated panels to form structures.

The EPA Environmental Photographic Interpretation Center (EPIC) archival aerial photographs of the plant site show the presence of four lagoon areas at the site from 1955 through 1970 (EPIC, August 1986). The approximate locations of each of these lagoons are shown in Figure 2-1, which also shows the plant buildings in plan view from about 1950 to 1970.

To date, much of the discussion of potential sources of the volatile organic contamination from the Bally plant has focused on these four lagoons. While there is reason to suspect that some of these lagoons may have received spent degreasing agents (i.e., volatile organics), these lagoons were reportedly shallow (i.e., maximum depth not greater than one foot), diked structures, built to contain the spent pickling liquors from the porcelain plating operations. Based on PADER analyses, these lagoons were characterized by elevated metals and sulfate levels, rather than by organic contamination.

The first series of two lagoons was apparently constructed prior to May 1955, based on a May 2, 1955 aerial photograph (EPIC, August 1986) and was backfilled prior to the mid-1960s as the plant buildings expanded to the southwest. At about this time, a series of two other lagoons was apparently constructed further to the south, as shown in Figure 2-1. The latter two lagoons were eliminated with the construction of the present plant office in 1970. These lagoons may not have been used after the late 1960s as production of the porcelain-faced meat display cases had ceased.

Initial use of degreasing agents at the Bally plant was concurrent with the switch to urethane foam as the insulation material for the meat display cases. A 2,000-gallon capacity tank was located at the former degreasing area in the northeastern portion of the plant, as shown in Figure 2-1. Prior to the application of the porcelain shells and the foam insulation, an overhead monorail crane was used to dip the entire case into the tank. Following dipping, the cases were set on the concrete floor and permitted to dry before being returned to the production line. Use of this degreasing tank was discontinued in approximately 1969, with the end of the case manufacturing operations.

A second degreasing area, shown in Figure 2-1 as the "small parts degreasing area," has been in use since the early 1960s for degreasing small parts used in interlocking the insulated panels. The tank at this location has a capacity of 600 gallons, but it usually contains less than 400 gallons of solvent.

Flushing agents have also been used to clean molds and urethane foam injection nozzles between mold shots. This activity has been ongoing since initial use of urethane foam in the production process in the mid-1960s.

All spent degreasing agents have been drummed and disposed off site through the services of a contract hauler and a disposer. The flushing agent is drummed and sent to a reprocessor; about 60 percent of the spent flushing agent is returned to the Bally plant, while the remainder is disposed by the reprocessor.

In summary, the initial use of pickling acids at the BES site occurred in the mid-1950s with the production of continuous line meat display cases. Solvents were not used in the production process until the mid-1960s, with the advent of urethane foam as the insulation material in the meat cases and insulated panels. Urethane foam insulation was used in the manufacture of the meat display cases from 1964 until the discontinuation of this line in 1969. The solvent used in the former degreasing area (2,000-gallon tank) was exclusively TCE.

The following chronology is provided for use of degreasing agents in the small parts degreasing tank (600-gallon tank):

August 1986 to present:	Eaken Saf-T-Sol 31
April 23, 1980 to August 1986:	Eaken Saf-T-Sol 15
Prior to April 23, 1980:	Eaken Saf-T-Sol 5

There is no reference in the plant operating records to specific degreasing agents prior to 1980. In addition to the Saf-T-Sol 5, chlorothane may have been used during this period.

Flushing solvents used in cleaning the injection nozzles in the foaming department follow:

January 1987 to present:	Methylene chloride (Chemical Solvents, Inc. SP-713)
July 1986 to January 1987:	Eaken Saf-T-Sol 12
February 1986 to July 1986:	Chemical Solvents, Inc. SP-711
July 1976 to February 1986:	Eaken Saf-T-Sol 12
October 1973 to July 1976:	Chlorothane VG
Prior to October 1973:	Trichloroethylene

Material Safety Data Sheets (MSDSs) for each of the solvents used are provided in Appendix A. General compositions are identified as follows:

Solvent	Active Agent/Constituents
SP-711	Trichloroethylene
SP-713	Methylene Chloride
Chlorothane VG	1,1,1-Trichloroethane
Saf-T-Sol 5	Methylene Chloride Tetrachloroethylene
Saf-T-Sol 12	Methylene Chloride Methanol Toluene
Saf-T-Sol 15	1,1,1-Trichloroethane
Saf-T-Sol 31	Hydrocarbons (no TCE/TCA)

2.1.2 Bally Municipal Wells

The Bally municipal wells (Well Nos. 1 and 3) represent the most significant potential receptors of site contamination. The location of each well is shown in Figure 1-1 with reference to the BES site.

Currently, about 1,200 residents of the Borough are served by the Bally Municipal Water Authority. Both municipal wells were intended to supplement the supply from a 270,000-gallon, spring-fed reservoir. The reservoir is located approximately 3,000 feet northwest of the Bally plant on a hillside overlooking Bally, and has not been adversely affected by the ground water contamination. By reference to Figure 1-1, it is apparent that this reservoir lies approximately at Elevation 640 feet mean sea level (ft-msl), about 160 feet above the BES site. The springs and reservoir are therefore hydrogeologically isolated from the observed ground water contamination.

Bally Well No. 1 has been in continuous service since October 1951. Bally Well No. 3 was placed into service in November 1979 and taken off line in December 1982 as a result of the volatile organic contamination found in October of that year. Well No. 3 was originally intended to be a back-up well. During the period when Well No. 3 was on line, the two wells were pumped on a weekly alternating basis, at a rate of 300 gpm for approximately five hours each day.

Specific data for each of the municipal wells, reproduced from Borough records, follows:

Municipal Well No. 3:

- Permit No. 0678502
- Drilled in 1977
- On-line in November 1979
- Depth to bedrock is 3.5 to 7.0 feet
- 300 gpm pump
- Safe yield is 0.324 million gallons per day (MGD)
- Gas chlorination treatment
- 300 feet deep
- 10-inch diameter
- 150 feet to pump
- 300-foot pumping head
- Static water level is 35 feet (following drilling)
- Pumping water level is 127 feet.

Municipal Well No. 1:

- Permit No. 8207-A
- Drilled in 1951
- Depth to bedrock is 96 feet
- Safe yield is 0.4 MGD
- 300 gpm pump
- Hypochlorinator

- 272 feet deep
- 10-inch diameter
- Static water level is 15 feet
- Pumping water level is 45 feet.

Table 2-1 shows the Borough's daily metered water consumption over the period from 1983 to 1987, since Well No. 3 was taken off-line. During this period, pumpage from Well No. 1 has generally accounted for about 50 percent of the total production of the Bally Borough water supply system. Actual production of water typically exceeds metered consumption by a substantial margin so that it is difficult to accurately define the actual quantities of water from Well No. 1 that are dedicated to potable uses.

2.1.3 Remedial Investigations/Actions To Date

The PADER conducted an evaluation of potential sources of volatile organic contamination to Well No. 3 following its closure in December 1982. The results of the PADER survey were reported in an internal memorandum dated March 28, 1983 (PADER, March 28, 1983). This report suggested that the BES site was a primary candidate source for the local ground water contamination. BES was advised of these findings by PADER via letter dated August 25, 1983. BES was not aware of any sources of contamination resulting from its activities. Nonetheless, BES representatives met with PADER in January 1984 to evaluate possible remedies for the ground water problem (Funk and Smith, October 27, 1986).

Subsequently, ERM was authorized by BES in September 1985 to conduct a Phase I Study (Data Review and Evaluation) and a Phase II RI to determine the source(s) of contamination to Well No. 3. The results of the ERM study were submitted in a report dated October 27, 1986 (Funk and Smith). During the course of the ERM Phase II RI on the site, five on-site and two off-site monitoring wells were installed. These 7 wells and 13 off-site residential/municipal/industrial wells were sampled and analyzed for chlorinated volatile organics, and five soil borings were performed with analysis of the soils for volatile organics. The soil borings were conducted in what was termed a "dirt area" approximately 315 feet southwest of Bally Well No. 3. This area had been identified in 1966 EPIC aerial photographs as a potential disposal area and a likely source of contamination for Well No. 3. The laboratory results for these soil samples showed no measurable levels of volatiles, however, and on this basis the "dirt area" was eliminated as a possible source of the contamination at Well No. 3.

In addition to the Phase II RI, the NUS Corporation Field Investigation Team (NUS/FIT) prepared a Preliminary Assessment/Site Investigation (PA/SI) report on the BES site. This report was submitted in September 1985 (Zima, et al., September 20, 1985). In conjunction with the PA/SI, NUS/FIT collected soil samples from an unpaved area east of the BES plant office and sampled the site well, both municipal wells, a well at the Washington Elementary School, and four domestic wells.

In an effort to continue the role that Well No. 3 had apparently played in confining contaminant movement, the Borough continued pumpage of the well to waste from 1982 until March 12, 1987. Pumpage was discontinued at that time due to the inability of the Borough to obtain necessary renewal of its surface water discharge permit from the PADER, Bureau of Water Quality. The permit had initially been issued for an interim period of two years to permit the Borough to develop a remedy for the ground water contaminant problem.

2.2 ENVIRONMENTAL SETTING

2.2.1 Hydrogeologic Setting

Bedrock occurring beneath the site is that of the Triassic Age Brunswick Formation, which consists of red shales, siltstones, and, in the Bally area, limestone fanglomerates. The fanglomerates are composed of limestone breccia and limestone pebbles in a sandy, argillaceous matrix. Unconsolidated material overlying bedrock consists of residual red-brown clays and silts weathered from bedrock and a thin mantle (0 to 10 feet thick) of alluvial material.

Ground water occurs within the Triassic Age Brunswick Formation primarily through fractures and joints. Within the limestone fanglomerate, subsequent solution activity has created higher porosity and permeability than the adjacent shales and siltstones.

The aquifer flow direction has been shown to be northeast, based on a water table contour map prepared from monitoring wells installed in previous studies. The existing conditions within the aquifer (static versus dynamic) at the time of water level measurements were not defined; the northeast gradient may be influenced by withdrawal from industrial and municipal wells in this vicinity. Static water table conditions may exhibit a different flow component and/or gradient.

The existence of a perched water table above the main aquifer has been implied in previous investigations. The confining layer for this zone is said to be a zone of lower permeability near the bedrock surface. This hypothesis cannot be supported from available data, and additional investigation is required to verify the inferred perched water table conditions.

2.2.2 Physiography and Site Drainage

The BES site is located near the contact of two physiographic provinces. The hills to the northwest of the site are composed of igneous and metamorphic units of Precambrian and Cambrian Age that occur within the New England physiographic province. The site lies within the Piedmont Upland physiographic province that occupies the lowlands east of the Precambrian and Cambrian Age hills. Relief between the two provinces is approximately 500 feet.

There is little topographic relief at the BES site and its immediate surroundings. The entire plant area lies at approximate Elevation 480 (±5) ft-msl.

The plant site comprises about one-half of a 40-acre watershed originating near the northeastern Borough boundary. The watershed is bounded on the west by an unnamed tributary to the West Branch Perkiomen Creek. The watershed is also bounded on the south by Barto Road and Route 100 and on the east by residential development. To the north, a man-made upland wetland exists approximately 300 feet from the site area.

Surface drainage from the plant does not flow onto the wetland but rather is directed to a storm sewer that runs along Main Street. The source of water to the wetland area appears to be surface drainage from springs originating northwest of Bally Municipal Well No. 3. Based upon data developed by previous ground water studies, the aquifer in the site vicinity does not appear to discharge to this area.

This wetland area, in part, is apparently the result of the infilling of an old man-made impoundment. This impoundment is evident on historical aerial photography as early as 1942 (EPIC, August 1986). In time, the pond received became completely silted in (circa, 1981). Presently, the wetlands area is characterized by a diffuse stream flow that constitutes an unnamed tributary to the West Branch Perkiomen Creek.

The southeastern perimeter of the plant site is serviced by a municipal storm sewer that includes an open ditch for approximately 200 feet in the plant vicinity. This sewer ultimately outlets to a sewer line servicing the main street of Bally.

Aside from the open sewer along the southeastern site periphery, surface runoff from the asphalt parking areas around the plant does not directly discharge to any surface water body. Parking and plant yard areas to the northwest of the plant buildings are gravelled and generate little runoff.

2.2.3 Adjacent Land Use

Bottomlands to the north and west of the BES site are predominantly dedicated to agricultural use, with some orchard production on the hill-sides. To the east and northeast, bottomlands surrounding a former 0.25-acre impoundment separate the plant area from Bally Well No. 3, a municipal recreation area, and residential development. A Mennonite church and cemetery lie along Barto Road and Route 100 immediately south of the plant site.

There is no evidence of critical habitats or presence of federally listed special-status species of wildlife within the site vicinity.

2.3 CURRENT SITE STATUS

2.3.1 BES Facility Operation

Figure 2-2 shows the current plant facilities in plan view, superimposed over the lagoons and showing the former and current degreasing areas. Specific zones of the plant are identified in this drawing.

BES has been pursuing a program designed to eliminate the use of degreasing agents containing TCE and TCA. At the present time, use of solvents is restricted to the small parts degreasing area and the foaming shop. In the small parts degreasing area, degreasing has been achieved with Eaken Saf-T-Sol 31, containing only hydrocarbons other than TCE and TCA.

Eaken Saf-T-Sol 12 was used from July 1986 through January 1987 in cleaning the injection nozzles in the foaming department; since that time, only methylene chloride has been used in this operation. BES is experimenting with the use of high-pressure urethane foam injection equipment that will ultimately eliminate the need for cleaning of the nozzles between mold shots.

Spent solvents from the small parts degreasing tank are drummed and stored in a fenced storage area at the extreme northwestern end of the plant property. Approximately 40 drums of solvents are generated every two months. Drums are monitored periodically for any leaks, and the drums are dated to ensure that storage does not exceed the 90-day limit established by the Resource Conservation and Recovery Act (RCRA).

2.3.2 Ground Water Users

Aside from Bally Well Nos. 1 and 3, the 1983 PADER survey identified industrial wells at the Great American Knitting Company and Bally Ribbon Company. The Bally Ribbon well lies immediately adjacent to Bally Well No. 1. Substantial quantities of ground water are apparently withdrawn, with a portion used in the plant's dyeing operation. Withdrawal from the Great American Knitting Company well is undetermined at this time. Detailed records of withdrawal at the industrial wells will be obtained during the preliminary data evaluation phase of the RI.

In addition to the industrial water uses, the PADER study identified approximately nine domestic wells in the Borough and its immediate vicinity. Section 2.5.1 provides specific location information for these wells in conjunction with a discussion of sampling in 1983 and 1986. Ground water withdrawal from the domestic wells is anticipated to be minimal since all Borough residents are serviced by the municipal water supply system.

The BES plant also operated a well to provide small quantities of cooling water; however, use of the plant site well was discontinued in 1981. At present, the BES plant obtains all of its potable and process waters from the municipal system.

2.4 PROPOSED ALTERNATIVE WATER SUPPLY

Following closure of Bally Municipal Well No. 3 for use as a public water supply in December 1982, the Borough of Bally continued to pump the well to waste. This action as taken to preserve the role that the municipal well had apparently played in containing the volatile contaminant plume. Discharge of water pumped from the well was to an unnamed tributary to the West Branch Perkiomen Creek, in accordance with a discharge permit issued by the PADER, Bureau of Water Supply to the Borough. This permit was originally intended to continue in force for a period of two years, or until the Borough had undertaken additional corrective action to preclude further spread of contamination in the aquifer. The permit lapsed in 1984, and PADER failed to respond to requests from the Borough for continuation of the permitted discharge. As a result, pumping of Well No. 3 to waste ceased on March 12, 1987.

Since cessation of pumping at Well No. 3, BES has been cooperating with the Borough and with the PADER to provide an alternative source of drinking water for the community. Based on an engineering evaluation done by Remcor in June 1987, the cost-effective alternative was determined to be air stripping of the discharge from Well No. 3 for use as a supplementary water supply when the springs to the northwest of Bally are insufficient to meet system demand. In addition to providing a needed alternative water supply, this action would permit continuous pumping of the aquifer through the municipal well to aid in controlling the spread of contaminants. Application materials for permits necessary to conduct this action (i.e., air quality, public drinking water supply, and National Pollutant Discharge Elimination System [NPDES] discharge permits) have been submitted and permit approval is anticipated in mid- to late-October. Construction of the treatment system and necessary piping will be completed within six weeks of permit approval, so that the entire system could be operational prior to the end of 1987.

The air stripping system will be a packed tower air stripper with induced draft. The system will consist of the column, blower, foundation, slab, and pump enclosure, and necessary piping and electrical wiring components. The system has been designed for a maximum flow of 300 gpm. The tower will be approximately 4 feet in diameter and 32 feet in height, and will be constructed of high-density polyethylene (HDPE), with carbon steel structural members. The packing will of the structured plate type. A booster pump will be provided with adequate capacity to pump treated water into the municipal distribution system.

Discharge from the well will be treated at all times to meet the more stringent of limits established in either the public water supply or NPDES discharge permits issued by PADER and will not exceed the acute or chronic AWQC for the protection of aquatic life. In this manner, the action will be consistent with both state and federal ARAR.

The establishment of wellhead treatment will be concurrent with performance of the RI/FS for this site, effectively obviating exposure of Bally residents to potable water containing volatile organic contamination in excess of maximum contaminant levels (MCLs) established pursuant to the Clean Water Act (CWA).

2.5 PROBLEM ASSESSMENT

This section defines the nature and extent of ground water contamination in the site area based primarily on the Phase II RI study (Funk and Smith, October 27, 1986) and provides an approach for the assessment of public health and environmental concerns. The Phase II RI report contains supporting documentation on sampling and analytical protocols and a more detailed presentation of the data from that study.

2.5.1 Nature and Extent of Contamination

During the course of the Phase II RI study, ERM sampled the five wells installed on site, two monitoring wells (nest) installed off site, the plant site well, Bally Well Nos. 1 and 3, industrial water supply wells at the Bally Ribbon Mill, and the Great American Knitting Mill, and nine residential wells northeast of the plant site. Figure 2-3 provides locations for each of these sampling points. Table 2-2 summarizes the analytical results. Predominant contaminants were 1,1-dichloroethene (DCE), TCA, and TCE. Figure 2-4 provides a graphical summary of the occurrence and distribution of selected chlorinated volatile organic contaminants. This figure is organized to portray contaminant levels found in 1986, generally proceeding from the southwest to the northeast across the BES site. As is evident from Figure 2-4, wells to the southwest of the site were uncontaminated, the highest levels of contaminants were found at the site and in Well No. 3, and contamination decreased markedly beyond Well No. 3, toward Well No. 1 and the surrounding residential and industrial wells.

With respect to the ground water contamination found on site, the highest level of volatile organic contamination (7,244 parts per billion [ppb]) was found in Well No. 86-4S (shallow well) near the northeastern corner of the main plant building. The deeper competent shale/fanglomerate bedrock unit on site, monitored at 86-3D showed generally lower levels of contamination than the shallow well at this location, possibly suggesting a confining or semi-confining layer that may mitigate downward migration of the volatiles into the deeper bedrock. The evidence for such a confining layer as a result of the Phase II study is largely circumstantial and will require confirmation through the Phase III RI study.

The presence of a reverse situation regarding contaminant levels at the 86-5 well nest (86-5S and 86-5D), that is, generally higher contamination in the deeper bedrock, is attributed to the effects of pumpage at Well No. 3. The pump at Well No. 3 is set at a depth of 150 feet and high volume pumpage of this well is presumed to have created a local vertical gradient within the zone of capture of the well (Funk and Smith, October 27, 1986).

The ERM Phase II study concludes that the contaminant distribution is controlled by two factors: (1) the principal ground water flow direction to the northeast, and (2) pumpage of Bally Well No. 3. High-volume (approximately 300 gpm) pumpage of Well No. 3 from 1979 through 1982 may have created a strike-parallel drawdown condition that caused ground water to flow preferentially toward the north.

The primary site contaminants found in off-site wells were DCE, TCA, and TCE. The highest level of total chlorinated volatile organic contamination found in off-site wells was in Bally Well No. 3 (3,509 ppb, of which 2,500 ppb was TCA). Well No. 3 is thought to have functioned as a "guardian" well during its active pumpage from 1979 to 1982, capturing the contaminant plume and accounting for the high levels of contamination found in this well in 1986. Figures 2-5 and 2-6 provide isoconcentration comparison plots for data obtained in the PADER 1983 off-site well survey and the sampling done by ERM in 1986. Figure 2-7 provides a graphical presentation of these data. From this plot, it is evident that off-site contamination is increasing as the historic effects of high volume pumpage at Well No. 3 diminish. This increase in contamination points to a need for remedial action in the near term to mitigate further spread of the plume.

As the EPA Region III Field Investigation Team (FIT) contractor, NUS Corporation (NUS) performed a preliminary assessment and site investigation (PA/SI) of the Bally site in 1985 in response t) contamination of Bally Municipal Well No. 3 with volatile organics. NUS collected 15 samples, including four on-site soil samples, one on-site ground water sample, eight ground water samples from wells surrounding the site and two field blanks (one solid, one aqueous). Soil auger samples No. 1, 2, and 3 were taken on the southeast side of the office building, which was believed at that time to have been the location of the former waste disposal lagoons. Further study of historic aerial photographs indicates that these samples were not located within the former lagoons. The aerial photographs reveal the lagoons to have been located on the northwest side of the office building and extending under the present production complex (Figure 2-2). The ground water samples were taken from nine wells previously sampled by the PADER in 1983. The wells included Bally Municipal Wells No. 1 and 3, an on-site wells no. 1, 2, and 3 on the Longacre Dairy Farm, the Gehman residence well, the Washington Elementary School well, and the effluent from Municipal Well No. 3.

The NUS/FIT results are of interest primarily because they represent the only full hazardous substance list (HSL) or CLP target compound list analyses of environmental samples from the Bally site. However, the organic results of the NUS/FIT sampling were reported as highly qualified and inconclusive due to abnormally elevated levels of contaminants not associated with the Bally site and apparent contamination of the field blanks. In particular, the chlorinated volatile organics of interest at the site (i.e., TCE, TCA, and DCE) were found in blank samples "at sufficient levels to question the aforementioned [i.e., organic data] sample results for these parameters" (Zima, September 20, 1985). Volatile organic contaminants were generally reported to be less than 10 micrograms per liter (μg/ℓ) in the ground water samples. Due to high blank contamination, the presence of a number of these compounds was questioned. However, significant concentrations of TCE and DCE were found in the following NUS/FIT samples. NUS/FIT Sample No. 5 appears to have been taken from the BES plant site well, although the well is incorrectly located in the PA/SI report:

NUS/FIT SAMPLE NO.	SAMPLE DESCRIPTION	CONCENTRATION (μg/ℓ)	
		TCE	DCE
5	BES Plant Site Well	415.18	6.28
6	Bally Well No. 3	484.7	175.72
7	Effluent from Well No. 3(1)	15.15	4.16
8	Mabel Gehman Well	238.17	3.28
12	Bally Well No. 1	4.88	0.58(2)

(1) Bally Well No. 3 pumping to waste during this period.

(2) Approximate quantification below detection limit; of questionable quantitative value.

Volatile organic contamination found in the three soil samples taken to the east of the BES office and a single surface soil sample taken from the perimeter of the BES drummed waste storage area was also found to be less than 10 micrograms per kilogram (μg/kg) and of questionable quantitative value.

The solid blank sample was not analyzed for acid and base/neutral (ABN) extractable organic compounds. The only measurable occurrence of ABN compounds in the soil and ground water samples analyzed was that of several phthalate species. These results were highly qualified, and were generally less than 1 μg/ℓ for the aqueous samples.

The inorganic analytical results were also highly qualified in the NUS/FIT data review (Zima, et al., September 20, 1985). Blank contamination lead to questionable results for a number of the metals. Nevertheless, none of the wells supplying drinking water contained Primary Drinking Water Standard (PDWS) metals in excess of the respective MCLs. The only case where a MCL was exceeded was in the BES plant site well (lead at 0.13 μg/ℓ). Metals analysis of the four soil samples showed generally low levels of inorganics, with the exception of aluminum and iron (mean values of 16 and 18 milligrams per kilogram [mg/kg], respectively). No "background" soil samples were taken during the NUS/FIT PA/SI to permit evaluation of these levels relative to naturally occurring metals in area soils.

2.5.2 Preliminary Assessment of Public Health and Environmental Concerns

2.5.2.1 Preliminary Risk Assessment

In accordance with guidance established by the EPA, a risk assessment will be performed during the conduct of the RI/FS to ensure that remedial actions attain a degree of cleanup that adequately protects human health and the environment. The purpose of this preliminary risk assessment is to review parameters relevant to a health-based risk assessment and to outline an approach for continuation and refinement of the risk assessment process.

2.5.2.2 Degree and Extent of Contamination

Information from earlier studies at the site indicates that ground water underlying and adjacent to the facility is contaminated with various chlorinated hydrocarbons (Table 2-2). Current information suggests that ground water is the only medium of concern.

Based on data shown in Table 2-2, the following four compounds are selected as indicator compounds:

- Trichloroethylene (TCE)
- 1,1,1-trichloroethane (TCA)
- Tetrachloroethylene (PCE)
- 1,1 dichloroethylene (DCE).

These indicator compounds have been selected based on their toxicity and prevalence in the ground water. Of the four indicator compounds, TCE and TCA were detected most often and at higher levels than other ground water contaminants. This contamination problem is consistent with the history of solvent use at the BES facility (Section 2.1.1). The highest levels of contamination have been found in wells adjacent to (86-3S and 86-4) and northeast of the facility (Bally Well No. 3). All of the indicator compounds are reported to leach into ground water fairly readily.

2.5.2.3 Toxicity

All of the indicator compounds may affect the human body through skin contact, ingestion, or inhalation. Of the four indicator compounds, TCA is the least toxic overall. Summaries of toxicological properties of the indicator compounds have been provided in the remainder of this section from Clement Associates (September 27, 1985).

TCA is quite volatile (vapor pressure equals 123 millimeters of mercury [mmHg] at 20 degrees Celsius) and is also generally less toxic than TCE and PCE. A study by the National Toxicology Program (1984) indicates that TCA increased the incidence of combined hepatocellular carcinomas and adenomas in female mice when administered orally. Other toxic effects of TCA are seen only at concentrations well above those likely to be encountered in an environmental (i.e., unconfined) setting. The most notable toxic effects in humans and animals are central nervous system depression. Impairment of coordination and equilibrium have been reported from exposure to air concentrations above 350 parts per million (ppm). TCA may also cause irritation to skin and mucous membranes. Acute toxicity studies report an oral LD_{50} in rats of 11,000 mg/kg.

Tetrachloroethylene, also called PCE or perchloroethylene, was found to produce liver cancer in mice when administered orally (National Cancer Institute, 1977). Renal toxicity and hepatotoxicity have been noted following chronic inhalation exposure of rats to PCE levels of 1,356 milligrams per cubic meter (mg/m^3).

TCE is carcinogenic to mice after oral administration, producing hepatocellular carcinomas (National Cancer Institute, 1976; National Testing Program, 1982). Chronic studies showed kidney, liver, nervous system, and skin toxicity in test animals following inhalation exposures to 2,000 mg/m^3 for six months. TCE has low acute toxicity with an oral LD_{50} of 6,000 to 7,000 mg/kg in several test species.

DCE is a volatile, water-soluble compound shown to produce kidney tumors and leukemia in one study of mice exposed by inhalation, but the results from other studies were equivocal or negative. DCE is mutagenic and it causes adverse reproductive effects when administered to rats and rabbits by inhalation. Chronic exposure causes liver damage and acute exposure to high concentrations produces nervous system damage. Volatilization appears to be the primary transport process for DCE and its subsequent photooxidation in the atmosphere is apparently the predominant fate process.

Cleanup criteria for ground water contaminants will be established during the course of the RI/FS. A primary objective of risk assessment is to establish cleanup criteria consistent with ARAR and risk to the public health or environment. There is presently little data upon which to base either quantitative risk calculation or cleanup criteria.

Criteria will be established by an examination of:

- Contaminants present in the ground water
- Potential exposure pathways for both human and environmental receptors
- Risks associated with potential exposures
- Accepted exposure standards for both human and environmental receptors.

A summary of health effects and chemical and physical properties of each of the indicator compounds is included as Appendix A in the Site Health and Safety Plan (Remcor, September 1987b), a companion document to this work plan.

2.5.2.4 Exposure Routes

The impending implementation of wellhead treatment at Bally Well No. 3 and subsequent reliance on this well as the primary alternative waster supply will essentially eliminate the threat of ingestion of contaminated drinking water. The water withdrawn from Well No. 3 will be treated to ensure compliance with limits established by the PADER Community Environmental Council (CEC) under a public drinking water supply permit. Continuous pumping of Well No. 3 is presently envisioned, with discharge of quantities exceeding the municipal system demand to an unnamed tributary of the West Branch Perkiomen Creek. This surface discharge will be in conformance with a NPDES permit issued by the PADER Bureau of Water Quality (BWQ), thus further ensuring that the stream and environmental receptors in this area are protected.

Wellhead treatment and continuous pumping of Well No. 3 will be implemented prior to the completion of the RI. Public health risk from exposure to the municipal water supply via exposure routes such ingestion, showering, cooking, and washing dishes and clothes will be addressed. However, the levels of chlorinated volatile organic contaminants found in the municipal supply will have been reduced by treatment to those specified in the public water supply permit.

3.0 SCOPING OF THE RI/FS

3.1 OBJECTIVES OF THE RI/FS

In general, the objective of the RI will be to characterize the site and surrounding ground water receptors in adequate detail to support the development of a comprehensive assessment of public health and environmental concerns. As subsequent sections suggest, the preliminary identified remedial objective for permanent, on-site remedial action is the pumping and treatment of ground water. Data must be collected to evaluate this action as well as identifying any other significant exposure paths and other possible remedial alternatives which are determined to be equally effective.

3.1.1 Specific RI/FS Objectives and Data Uses

3.1.1.1 Remedial Investigation Objectives and Data Uses

Source Characterization

Previous studies have determined that the BES plant is a source of volatile organic contamination to the surrounding aquifer. However, specific source areas at the plant have not been identified. Based on historic operational data, the primary candidate source areas are the former and existing degreasing areas. Past emphasis on the lagoons that received spent acid solutions in the 1950s and 1960s appears to be unwarranted. In consideration of these facts, the RI will attempt to define the source of volatile organic contamination at the degreasing areas. The lagoon areas underlying the present plant buildings will also be sampled to test the hypothesis that these areas are not a source of volatile organic contaminants to the aquifer.

Plume Characterization

Installation of additional monitoring wells has been proposed to augment the present network of monitoring and domestic wells in a manner that will permit evaluation of the lateral and vertical extent of contaminant migration from the source areas. Characterization of the contaminant plume is a necessary prerequisite to definition of remedial alternatives designed to manage migration through ground water interception and treatment.

Hydrogeologic Evaluation

The RI will establish aquifer performance characteristics (e.g., specific capacity, transmissivity, and storage coefficients) and expected yields and anticipated zones of influence from potential ground water interceptor wells. This data will be obtained through a baseline ground monitoring of the aquifer, aquifer testing in specific wells and conduct of a 48- to 72-hour continuous pumping test.

Discharge of Contaminated Ground Water to Surface Water

The remote potential exists for discharge of contaminated ground water to surface water in a man-made wetland immediately north of the BES plant. Samples of surface water will be collected from this area and tested for volatile organic contaminants to evaluate whether this migration pathway should be considered further. In addition, periodic monitoring of discharge at the NPDES outfall from the Well No. 3 treatment system will ensure that contaminants are not entering the wetland from this source.

Evaluation of Public Health and Environmental Concerns

With installation of treatment at Well No. 3 and sole reliance on this source to supplement the municipal water supply, exposure of Borough residents to contaminated drinking water is effectively limited to those few individuals who voluntarily choose to use their private wells rather than the municipal system. This issue is clearly the responsibility of the local or state health departments, and will not be addressed as an exposure pathway in the RI/FS. The RI risk assessment will examine public health concerns resulting from use and ingestion of water in the municipal water supply system following implementation of wellhead treatment and reliance on Bally Well No. 3 as the primary alternative water supply for the Borough.

There will remain an area between Bally Well No. 3 and the BES plant where ground water contaminant levels may exceed those of the treated discharge from the well. Left unabated, this situation would persist until contamination had been effectively purged from the aquifer by pumping at the municipal well. There are neither residences nor domestic wells within this area. The zone currently supports a man-made, upland wetland community. The wetland arose as a result of infilling of a reservoir and breaching of the dam sometime between 1981 and 1984 (EPA, August 1986). The risk assessment will examine possible adverse chronic effects on aquatic life via volatile organic contaminants from the BES plant in the event that surface water sampling evidences levels of concern.

3.1.1.2 Feasibility Study

Adequate data are presently available to permit design of the wellhead treatment system at Well No. 3 to meet discharge requirements to be established by the PADER. A geotechnical investigation was performed in July 1987 to obtain necessary data relative to foundation design. Wellhead treatment will be undertaken concurrent with the performance of the RI/FS. As a result, the data base available to the FS will consist not only of that obtained in the RI but also will contain chemical-analytical and hydrogeological data obtained during the operation of the wellhead treatment system. These data will ensure adequate information with which to measure the effectiveness of the wellhead treatment system and, if necessary, to design additional controls to supplement or enhance pumping and treatment at Well No. 3.

The focus of the FS will therefore be to determine whether additional engineering controls (e.g., ground water interception and treatment between the BES plant and Well No. 3) can significantly enhance remediation of the aquifer and/or provide additional benefits to the public health or environment. The FS will also consider the technical feasibility, cost, and level of benefit achieved through control of volatile organic contaminant sources at the BES plant, should concentrated sources be found to exist.

3.2 DATA QUALITY OBJECTIVES

Having identified RI/FS objectives and data uses in Section 3.1.1, this section discusses requirements for precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters, as defined in "Data Quality Objectives for Remedial Activities" (EPA, March 1987).

3.2.1 Definitions

- Precision - A measure of the reproducibility of measurements under a given set of conditions.
- Accuracy - A measure of the bias (i.e., error) in a measurement system.
- Representativeness - A relatively subjective measure of the degree to which the sampling methodologies permit collection of typical samples.
- Completeness - A measure of the percentage of all measurements judged to be valid results, that is, not rejected in the data validation step.
- Comparability - A qualitative expression of the confidence with which one data set can be compared against another.

3.2.2 Quantitative PARCC Requirements

Methods for quantitation of precision and accuracy have been discussed in Section 10.2 of the FSAP. Completeness requirements for laboratory data are best established after the analytical results are received and other data have been collected regarding hydrogeologic characterization of the study area. Representativeness and Comparability are subjective parameters for which strict quantitative DQOs have not been established.

3.2.2.1 Field Screening (Data Quality Level I)

Instrumentation will be employed as outlined in the FSAP to permit collection of real time screening data (DQO Level I) relative to the following: volatile organic content of soils, surface waters, and ground water; and pH and conductivity of surface and ground water. Accuracy will be ensured by calibration of the field instruments in accordance with the methods and calibration schedules established in the FSAP.

Establishment of precision and accuracy DQOs for measurements from field instruments is difficult because of the greater opportunity for uncertainty (error) in the measurements, in comparison to that encountered in the more controlled laboratory setting. Knowledge of the precision and accuracy incorporated in the field measurements is of value, however, because such measurements may be used to select samples for laboratory analysis, and/or may dictate the range and extent of sampling (e.g., elevation and length of well screen). Guidance for establishment of DQOs presently available from the EPA (March 1987) does not report any historic data relative to precision and accuracy of measurements made with the instrumentation to be used in the present RI.

3.2.2.2 Laboratory (DQO Level IV)

Precision and Accuracy

All laboratory analyses will be conducted in accordance with the most recent CLP Statement of Work for Organics Analysis (CLP, October 1986). As such, these data will commensurate with DQO Level IV; precision and accuracy DQOs will be as established in the Statement of Work (CLP, October 1986).

Field quality control samples will be obtained as specified in Section 10.2 of the FSAP. These will include field replicates and both field and trip blanks. Laboratory quality control will be in accordance with the Statement of Work (CLP, October 1986). The quality control program thus defined will ensure measurement of total system (i.e., sample collection, handling, processing, transport, and laboratory analysis) variability.

Representativeness

Representativeness has been incorporated in the design of the sampling program. Soil sampling in the former lagoon areas provides for collection of samples above, at, and below the suspected base of the lagoon at two locations in each of the four former lagoons. The operating hypothesis is that the lagoon contents were relatively homogeneous when initially deposited, and have been intermixed with other soil materials during subsequent regrading and building expansion. These lagoons received predominantly inorganic wastes, and are not anticipated to represent sources of volatile organic contamination to the aquifer. Sampling the lagoons at a greater frequency would, therefore, not produce results more representative of residual contamination than that proposed.

The ground water monitoring network to be installed in the RI has been designed to augment the existing domestic and monitoring wells. Following installation of the 13 additional wells, well clusters (i.e., shallow, intermediate, and deep monitoring points) will be available at seven points, providing adequate lateral and vertical coverage within the aquifer.

Surface water samples will be taken from the man-made wetland immediately north of the BES plant. There is no evidence that contaminated ground water discharges to the wetland at present; if present, volatile organic contaminants should be distributed generally throughout the small wetland area. The specific location of sample collection is, therefore, not a guiding factor in ensuring that samples drawn from this area are representative.

Completeness

Completeness of the analytical data base will be evaluated following validation pursuant to the EPA "Functional Guidelines" (EPA, April 1985), and hydrogeologic characterization of the study area in the RI. At the present time, it is impossible to establish which of the proposed sampling points are critical to successful interpretation of the degree and extent of contamination. Initially, a high level of completeness will be required, primarily because single sampling tours are anticipated for each medium.

Should soils data from the lagoons consistently show absence of volatile organic contamination, completeness requirements may be less stringent. Field screening data will provide a measure of redundancy for laboratory analysis of soils taken from the suspected source areas (existing and former degreasing areas). The completeness requirement for laboratory analytical results will be based on the screening results. A higher completeness requirement will be placed on the laboratory results if screens indicate the presence of concentrated zones of contamination be found that may be amenable to specific source control measures.

The completeness requirement for the surface water sample is obviously 100 percent, since only a single location will be sampled. The need for completeness in the results of ground water and domestic well analyses will be a function of the lateral and vertical extent of contamination found. Adequate completeness will be required to permit definition of the present approximate limits of contamination, as well as to generally predict the rate and direction of future movement. Exposure to a contaminated drinking water supply will be curtailed via implementation of treatment at Well No. 3. This action obviates the need to achieve a high degree of completeness in the domestic well analyses in order to address risk to public health.

Comparability

Comparability of the laboratory data will be evaluated following receipt of validated results. As noted, results from the former lagoons are anticipated to be in good agreement with one another. Trends in contaminant levels in the soil samples taken from the suspected source areas should be supported by the data, and the data should generally agree with trends in contaminant distribution defined via OVA screening in the field. Strict numerical comparisons between field OVA results and laboratory results are generally not appropriate; however, any laboratory data that show volatile contamination significantly below that found in the field may be considered questionable due to the possible loss of volatiles in transit.

Comparability of the ground water results obtained in the RI will be examined to determine weather it is consistent with knowledge of hydrogeologic conditions and past definition of the degree and extent of volatile organic contamination within the aquifer.

3.2.3 Statement of Data Quality Objective Sufficiency

The RI employees two DQO levels. DQO Level I (field screening data quality) involves the use of an OVA to provide real time, semi-quantitative information regarding the presence or absence of volatile organic contaminants in soils, surface waters, and ground water. In so doing, this screening will permit informed field decisions relative to the extent of sampling required to ensure that contamination is representatively characterized. Field screening data will establish trends in degree and extent of contamination that will be further quantified through laboratory chemical analyses; field results will be used to optimize allocation of laboratory analytical resources, focusing on areas of higher contamination and verifying screening data which show absence of contaminants in certain critical areas.

DQO Level IV is implicit in the final ACO (EPA, January 28, 1987). Section X of the ACO requires adherence to follow CLP protocols in laboratory analyses. In part, because of the impending installation of treatment at Well No. 3, the preliminary evaluation of public health and environmental concerns contained in this SOW does not attempt to establish risk-based target cleanup levels. It is anticipated that the PADER will require water discharge from the treatment system to the Bally municipal water supply to meet MCLs established pursuant to the CWA. MCLs are technology-based, legally-enforceable standards. The contract required detection limits (CRDLs) established by the most recent CLP Statement of Work (CLP, October 1986) do exceed the final or proposed MCLs for the volatile organic contaminants of interest, with the exception of that for TCA (200 μg/ℓ). However, NUS Laboratories, selected by Remcor to provide subcontract laboratory support, has agreed to report approximate quantitation results for chromatogram peaks for volatile organic species of interest, where measurable peaks occur below the CRDL. This level of data quality will be acceptable in performing the required assessment of public health and environmental concerns in the RI. At the present time, there is no basis for requesting enhanced detection limits.

3.3 PRELIMINARY DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

This section of the Work Plan discusses potential risk to human health or the environment, and regulatory requirements. These factors provide the background necessary to establish cleanup objectives for remedial action at the BES site. These objectives then form the basis for a preliminary evaluation of remedial technologies capable of achieving site cleanup.

Once remedial action objectives and potential remedial technologies have been identified, the objectives of the RI study are defined. A distinction is made between remedial action (i.e., cleanup) objectives and the objectives of the remedial investigation. One of the principal objectives of the RI, for example, is to provide adequate data to permit evaluation of cleanup technologies in the FS. The RI scoping contained in this section ensures that the FS data requirements will be met.

3.3.1 Public Health and Environmental Concerns

Implementation of wellhead treatment at Bally Well No. 3 is anticipated concurrent with the performance of the RI. Ultimately, this will permit primary reliance on this well as an alternative source of potable water for the Borough. Discharge of treated water to a nearby, unnamed tributary to the West Branch Perkiomen Creek will also be ongoing during the wellhead treatment, and will be in accordance with discharge limitations established in an NPDES permit.

The assessment of public health and environmental concerns incorporated in the RI will be performed after wellhead treatment is operational, and will consider the effect of this action in mitigating exposure routes to both the general public and the environment.

3.3.2 Preliminary Development of Applicable, or Relevant and Appropriate Regulations

Section 300.68(e)(1) of the National Contingency Plan (NCP) (final rule published at 50 Federal Register [FR], Vol. 50, No. 224, pp. 47912-47979, November 20, 1985) requires that development of remedial action objectives at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites provide a determination of which federal or state public health and environmental standards are "Applicable, or Relevant and Appropriate Regulations" (ARARs). Other federal criteria, advisories, and guidance may be considered ARARs in developing cleanup requirements. The SARA of 1986 extended the applicability of ARARs to state environmental or facility siting laws which are more stringent than comparable Federal ARAR requirements.

This section provides a preliminary development of the primary ARARs for the BES site to be used in guiding the initial development of remedial actions. Further development of ARARs will be required through meetings and discussions with the EPA and commenting federal agencies such as the U.S. Fish and Wildlife Service (USF&WS) as well as with the PADER. It is anticipated that EPA Region III and the PADER, Bureaus of Solid Waste, Water Quality Management, and Community and Environmental Control, will coordinate definition of the federal and state ARARs during their review of this draft document.

3.3.2.1 Applicable Requirements

Applicable requirements, as defined in Section 300.6 of the NCP, are "those federal requirements that would be legally applicable, whether directly, or as incorporated by a federally-authorized state program, if the response actions were not undertaken pursuant to CERCLA Section 104 or 106."

BES is performing the RI/FS under the requirements of an ACO issued pursuant to the authority given by CERCLA Section 106(a); however, Section

XI of the ACO requires that all response actions be performed "in accordance with the requirements of all applicable local, state, and federal laws and regulations."

The only applicable federal or state regulations to the remedial investigation and remediation of the BES are the following:

- OSHA Requirements - All U.S. Department of Labor Occupational Safety and Health Administration (OSHA) requirements are applicable for personnel on site during the RI field investigation. In particular, the OSHA Interim Final Rule on Hazardous Waste Site Operations (29 Code of Federal Regulations [CFR] 1910.120) will be applicable to the development and implementation of health and safety programs and training requirements for contractor and subcontractor personnel where the potential exists for either contact with hazardous wastes or the need for respiratory protection. Several OSHA requirements, including protection from dermal contact and breathing zone threshold concentrations, will also be applied to the RI field study and subsequent remedial action.

- RCRA/DOT Requirements - Both the RCRA and U.S. Department of Transportation (DOT) regulate transport of hazardous waste materials and are generally applicable to CERCLA remedial investigations and remedial actions. DOT requirements will be adhered to in the shipment of waste samples for analyses; however, due to the small quantities involved specific RCRA manifesting requirements will not be considered applicable.

  RCRA Section 261.4(d) exempts samples from the regulations contained in 40 CFR Parts 262 through 267 or Part 270 or Part 124, if samples are being managed as follows:

  - Transported to a laboratory for the purpose of testing.

  - Transported back to the sample collector after testing.

  - Stored by the collector prior to transport to the laboratory.

- Stored at the laboratory.

To qualify for the above exemption, Section 261.4(d)(2)(i) requires that any transportation comply with DOT shipping requirements. The applicable DOT requirements will be followed during shipment of samples.

- PADER Bureau of Water Quality Discharge Permits - The RI SOW anticipates conduct of a short duration (48 to 72 hours) pumping test with discharge of effluent from the pumping well to a nearby watercourse. Such action requires approval in the form of an Emergency Discharge Permit from the PADER Bureau of Water Quality.

3.3.2.2 Relevant and Appropriate Requirements

Although not legally applicable, certain public health and environmental requirements, guidance, and advisories may have been promulgated to address situations similar to those anticipated at the BES site.

Relevant and/or appropriate requirements have been summarized below and will be considered in the development of remedial cleanup objectives. ACLs may be established to serve as a basis for ground water cleanup in accordance with the Draft Guidance on Development of ACLs Under RCRA.

Relevant and Appropriate Federal Standards

- RCRA Ground Water Protection Standards - These standards are not applicable to historic sources of ground water contamination originating prior to enactment of the regulations. However, the chlorinated volatile organics found in ground water at the site are "hazardous constituents" as defined in RCRA Appendix VIII. RCRA ground water protection requirements (40 CFR, Part 264, Subpart F) are therefore relevant and appropriate to development of remedial cleanup objectives.

- Safe Drinking Water Act (SDWA) Primary Drinking Water Standards - In accordance with the final draft EPA Ground Water Protection Strategy (EPA, December 1986), the aquifer underlying the BES site may be considered a Class II Aquifer. In light of the reduced demand on the aquifer in the

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site vicinity for potable water supply since the closure of Well No. 3 in 1982, the aquifer in the BES vicinity may be classed IIA (current potable supply) or IIB (potential supply).

Contamination of municipal and domestic wells has occurred. Therefore, the SDWA MCLs and Maximum Contaminant Level Goals (MCLGs) are considered relevant and appropriate to development of clean-up criteria. The intent of MCLGs is to define levels at which no known or anticipated adverse effects would occur. MCLs are federally enforceable, technology-based standards, whereas MCLGs are not federally enforceable, per se.

- Safe Drinking Water Act (SWDA) Secondary Drinking Water Standards - SDWA Secondary Drinking Water Standards serve as guidelines to maintain aesthetic qualities (i.e., odor and taste) in drinking water supplies. As such, they are not federally enforceable.

- Clean Water Act Water Quality Criteria - EPA Water Quality Criteria have been established under Section 303 of the CWA, based on water use. These standards are not federally enforceable, but are considered relevant and appropriate to cleanup actions under CERCLA by Section 121 of the SARA. Since ground water from the BES site does not discharge to the nearest surface water (West Branch of the Perkiomen Creek) within a reasonable distance, only the Water Quality Criteria relative to human consumption may be considered relevant and appropriate.

- USEPA Drinking Water Health Advisories - According to the Draft Superfund Public Health Evaluation Manual Drinking Water Health Advisories are considered relevant to establishment of risk-based cleanup levels at CERCLA sites.

Relevant and Appropriate State Standards

ARAR from the State perspective was reviewed in concert with those regulations immediately applicable to permitting of the wellhead treatment system at Well No. 3. ARAR include adherence to air emissions standards from air stripping treatment systems pursuant to regulations of the PADER, Bureau of Air Quality Control (BAQC), as well as the requirement for Public Water Supply Permit for discharge of treated water to the municipal supply (PADER, CEC) and a state NPDES permit (PADER, BWQ) for discharge of treated effluent to the unnamed tributary of the West Branch Perkiomen Creek.

If the need for additional remedial measures becomes apparent following implementation of wellhead treatment, consideration of other ARAR will be undertaken. Development of additional ARAR, if required, will be done in consultation with Mr. Thomas Sheehan (PADER, Bureau of Solid Waste [BSW]), State Project Officer for the Bally RI/FS.

3.4 PRELIMINARY DEVELOPMENT OF REMEDIAL ACTIONS

In concert with "Interim Guidance on Superfund Selection of Remedy" (Porter, December 24, 1986), one of the most significant features of the SARA is the increased emphasis on treatment to "significantly reduce the toxicity, mobility, or volume of wastes" and the requirement for selection of a remedy "that utilizes permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable." Traditionally, remedial actions at uncontrolled hazardous waste sites have been categorized as either source control (on site) or management of migration (off site) actions, or some combination of these categories. In the present case, contaminants have already migrated into the aquifer. The transient nature of chlorinated volatile organics reduces the probability of finding a concentrated source. Unless evidence of the persistence of a concentrated source of contaminants can be found in the RI, the major focus of remedial action at the BES site will remain the control of further migration of contaminants into the aquifer and cleanup of the existing contamination.

Contaminant levels have been increasing in domestic wells northeast of the BES site, as well as in Bally Well No. 1, since the discontinuation of high-volume pumping at Bally Well No. 3 in 1982. It is apparent that the action should be taken without any undue delay to capitalize on the effect that the pumpage at Well No. 3 may have had in mitigating spread of the contaminant plume.

In consideration of the need for reliable alternative water supply, BES and the Borough of Bally are pursuing installation of wellhead treatment at Well No. 3. Pumping at this location will tend to draw volatile contaminants from the aquifer, eventually reclaiming the aquifer. Additional remedial action may be required . The need for such action will be evaluated in the FS after monitoring of the effects of wellhead treatment.

Although ground water treatment appears to be the most viable and cost efficient remedial action at BES, other remedial actions will be evaluated. Measures such as a chemical treatment and source removal will be evaluated in a focused FS.

4.0 RI/FS SCOPE OF WORK

4.1 INTRODUCTION AND RATIONALE

The RI/FS described in this work plan consists of 14 specific tasks, as detailed in Table 4-1. The present SOW has been prepared following an initial site reconnaissance and review of available site data, including EPA comments on the Phase II ERM Report (Vitale, Cromer, and Glenn, January 8, 1987; Orient and Evans, January 23, 1987). In accordance with the current analytical data base, knowledge of solvent use at the BES facility, and the requirements of the ACO, the problem to be addressed relates to aquifer contamination with chlorinated volatile organics. The proposed Phase III RI/FS therefore focuses on these contaminants and means by which their migration may be constrained and aquifer renovation may be achieved.

While no substantive modifications are anticipated in this scope as a result of further data review, Task 1 (Evaluation of the Current Situation) provides the opportunity to acquire data necessary to refine the SOW further to ensure that the objectives of site characterization are achieved.

Task 2 (Planning and Management) includes preparation of the draft and final work plans, as well as the Field Sampling and Analysis Plan (FSAP) (Remcor, September 1987a) and Site-Specific Health and Safety Plan (HASP) (Remcor, September 1987b). This task also includes procurement of subcontractors, access to the surrounding area for field activities, and any necessary permits. Administrative functions, such as monthly progress reports to the EPA, meeting attendance, and community relations support will be performed under this task.

Following review of additional data, and refinement of the work plan incorporating EPA comments, Remcor will initiate the site investigation. The investigation includes a hydrogeologic investigation and focused surface water sampling program. The hydrogeologic investigation is designed to define the vertical and lateral extent of contamination and the characteristics of the aquifer necessary to determine site remediation. The surface water investigation will define the relationship of the site to an adjacent wetlands area.

A Baseline Ground Water Survey (Task 3) will be conducted initially to provide background data for the conduct of the hydrogeologic study which forms the major focus of the investigation. Installation of 2 deep bedrock, 7 intermediate, and 4 shallow wells is currently proposed, to be followed by sampling and analysis of the 8 existing monitoring wells, 13 residential/industrial/municipal wells off site, and the 13 wells installed during the Phase III RI study. Following sampling, an aquifer performance test (i.e., pumping test) will be undertaken to characterize functional characteristics of the aquifer (e.g., hydraulic conductivity, transmissivity) necessary to design a ground water recovery system.

4.2 STATEMENT OF WORK

The following sections describe the work to be undertaken by Remcor under the BES RI/FS. This work plan complies with the requirements set forth in the ACO, the EPA guidance documents for remedial investigation and feasibility studies released in June 1985 (EPA, June 1985a; June 1985b), and recent EPA internal memoranda for remedy selection in light of SARA Section 121 (Porter, December 24, 1986).

4.2.1 Remedial Investigation

The strategy developed by Remcor addresses the following data gaps existing for the site:

- The determination of the specific source(s) of contamination at the Bally site
- The characterization and volume estimation of the waste source(s)
- The delineation and flow direction of the volatile organic contaminant plume

- The determination of site-specific aquifer characteristics.

Task 1 - Evaluation of Current Situation

A site reconnaissance and review of plant records were conducted on April 9 and 10, 1987, preparatory to the development of this work plan. The objective of Task 1 is to collect and review additional data to further define the required scope of investigation. Existing information will be retrieved and compiled relative to potential contaminant sources, site migration pathways and receptors, and potential impacts on human health, welfare, and the environment. Special attention will be given to determining if waste disposal areas exist beneath the plant building. All available operational and environmental data will be reviewed to establish the following:

- Site background
- Nature and extent of problem
- History of response actions
- Evaluation of remedial technologies.

In addition to an evaluation of plant records and background information, a review of existing ground water conditions will be undertaken. Presently, data appears lacking on the effects of pumping of the aquifer from the municipal and industrial wells in the Borough of Bally. In order to determine optimum drilling locations for well installation during the site investigation, a comprehensive review of private and public wells in the site vicinity will be conducted. This review will include interviews with public officials, industries, and private well owners. Specific information to be obtained will be well depth, well logs (if available), yield, usage, and relative pumping rates and withdrawal periods.

These data will be used to evaluate the static and dynamic conditions occurring within the aquifer as a result of periodic ground water withdrawal as a basis for the Baseline Ground Water Survey to be undertaken as Task 3.

Also during this task, key Remcor professionals will inspect the site and conduct the evaluations needed for site planning. The project manager and remedial investigation principal investigator will establish boundary conditions for remedial investigation work. The site health and safety officer will conduct an initial site reconnaissance to establish levels of personnel protection.

Task 2 - Planning and Management

This task includes activities oriented toward planning and administrating the work required to conduct an RI at the Bally site. To ensure that all field activities are clearly defined and in accordance with EPA Region III protocols, a Remedial Investigation Site Operations Plan (RISOP) will be prepared.

The RISOP will consist of the FSAP (Remcor, April 1987a) and the site-specific HASP (Remcor, April 1987b). The FSAP will describe procedures and methodologies to be utilized during the various field investigations. It will define the number and types of samples to be obtained, their locations, and the various sampling methods for different media. It will also describe the procedures employed for drilling and monitoring well installation and equipment decontamination.

The FSAP and Work Plan will describe all necessary quality control requirements as specified in "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (EPA, December 29, 1980). A separate Quality Assurance Project Plan - Index has also been prepared to reference the location of specific quality control provisions in both documents to the standard outline presented in the EPA Guidance.

The site-specific HASP will be prepared based on the initial site reconnaissance by the project health and safety officer. This plan will specify the required level of protection and monitoring, as well as personnel training needed for the various tasks. Rationale for the levels of protection required will be discussed. This plan is considered a working document and will be modified during the remedial investigation as data are generated for the site.

Reports detailing technical progress will be submitted to BES and the EPA on a monthly basis. The reports will describe the work completed to date, project status, anticipated changes in scope, and any special conditions and problems encountered. The report will also outline future activities and will discuss proposed changes in future activities based on pertinent findings.

Community relations support will include preparation of information for inclusion in fact sheets and attendance at public briefings and meetings as requested by BES.

This task also includes procurement of subcontractors for the following activities:

- Drilling and monitoring well installation
- Geophysical borehole logging
- Laboratory analysis
- Ground survey
- Data validation.

All necessary permits and access will also be obtained in this task.

Task 3 - Baseline Ground Water Survey

Mobilization

Upon arrival at the site, a field office will be established that will serve as the operations and communications center for all remedial investigation activities. The office can be a trailer located on BES property or it will consist of office space made available at the plant. Telephone service will be available for communication with all concerned parties. The major field equipment needed for the performance of the ground water survey and subsequent RI field activities will be stored at the office. This equipment may include, but not be limited to, the following:

- Surveying equipment
- Sampling equipment
- Health and safety supplies and equipment
- Decontamination equipment
- Ground water measurement equipment
- Drilling equipment and supplies.

The field office will also serve as a preparatory and packaging area for all analytical samples and for storage of all samples (geologic) not sent for chemical analysis.

Baseline Ground Water Survey

Data obtained from an inventory of residential, municipal, and industrial ground water withdrawal in Task 1 will be evaluated to determine what effect, if any, these wells have on the aquifer in the site vicinity. In addition, some abandoned or little used wells may be identified with the owners' permission to serve as water level measurement points to better define flow direction.

A second part of this subtask will be the evaluation of aquifer response to large-scale pumping that will occur with wellhead treatment at Bally Municipal Well No. 3. This evaluation will consist of the measurement of water levels in nearby wells prior to and during withdrawal periods. To aid in this evaluation, continuous water level recorders will be installed on three wells to continuously record aquifer response to non-pumping and pumping periods. The survey will be initiated two weeks prior to air stripping and will continue for at least a four-week period. The wells utilized for continuous recording will be Monitoring Wells 86-3D, 86-5D, and proposed Well 87-7I (shown in Figure 4-2). These wells will provide data on aquifer response for long-term pumping conditions. Water levels will also be obtained on a frequent basis from other nearby wells both during pumping and non-pumping conditions. These data will be related to the continuous recording measurements to determine the zone of influence created by pumping Bally Well No. 3. These data will provide a better understanding of site hydrogeology under current baseline conditions and will aid in ground water flow direction assessment during Task 5, the hydrogeologic assessment. The generated data will also be of use in determining aquifer parameters and capture zone geometry.

It is anticipated that this study will be ongoing during completion of drilling and installation of monitoring wells. However, the actual schedule is dependent upon implementation of wellhead treatment at Well No. 3. Permit authorization for this activity is currently pending approval from the PADER, but is expected by mid to late October. In the event that the baseline study and well installation cannot be undertaken concurrently, cooperation of BES personnel will be needed to conduct this study. This will require daily monitoring of the continuous recorders and the changing of chart paper on the recorders at the conclusion of a measurement cycle (once per week). Remcor personnel will initiate the study (set up the recorders) and collect water levels from nearby wells during pumping and non-pumping conditions at a minimum of once every two weeks.

Task 4 - Source Characterization

This task will investigate all presently identified potential sources of contamination at the BES site to characterize possible contributions to the ground water contamination occurring in the Borough of Bally. The potential for further contamination will be assessed. The extent of contaminated soil or waste will also be defined so that volume estimates of the source material can be made. The potential source areas of contamination have been identified as four former waste lagoons and the former and current (i.e., small parts) degreasing areas (Figure 2-2).

Lagoon Areas

The four lagoon areas known to exist at the BES site will be investigated by the sampling of subsurface soils at these locations to determine the presence or absence of contamination and to obtain approximate volume estimates of any encountered waste materials. Eight sampling locations will be necessary, as shown in Figure 4-1. Borings SS-1 through

SS-4 will be drilled outside the plant in the breezeway between the office and production areas of the plant. Borings in this area will be drilled by a small geotechnical drill rig capable of taking split-spoon samples. Drilling in this area will proceed to the top of bedrock.

It is anticipated that physical evidence of the lagoons remains in the subsoil. Analytical soil samples will be taken via split-spoon samplers from materials that occur within the former lagoon, immediately below the base of the lagoon and two feet below the base of the lagoon to characterize the vertical distribution of contamination from the lagoon areas. The split-spoon samples will be taken continuously to a depth of ten feet and at three-foot intervals thereafter. The field geologist retains the option to modify the sample frequency based on subsurface conditions.

Sampling locations SS-5 through SS-8 are proposed to sample waste lagoons believed to be present (based on May 2, 1955 aerial photographs, EPIC, August 1986) under the main plant building. These borings will utilize a coring machine to drill through the concrete floor and a bucket auger to sample soils beneath the floor. Where necessary, a portable power auger will be used to advance the soil borings to the desired sampling depth. Analytical sampling intervals will be identical to those used at SS-1 through SS-4: within the former lagoon, immediately below the base of the lagoon, and two feet below the base of the lagoon.

All samples selected for chemical analysis will represent a six-inch interval and will be transferred from the sampling device by a clean stainless steel trowel to laboratory-certified clean sample jars. All sampling equipment utilized will be decontaminated with pressurized steam between each use. Replicate sampling devices will be available so that decontaminated equipment is always readily available.

Of the 24 samples collected for analyses from the two areas, 8 will be selected for CLP volatile organics analysis. The remaining 16 will be retained in a secure area for possible future reference (e.g., physical characterization) and will not be available for volatile organics laboratory analysis. Chain-of-custody procedures will be strictly followed during all phases of sample collection, processing, and shipping.

In addition, the borehole and all drill cuttings will be scanned with an organic vapor analyzer (OVA) during drilling. Headspace analysis will be conducted on all jarred samples to determine gross volatile organic content of the various materials encountered.

Upon completion of drilling, all boreholes will be sealed to ground surface with a cement/bentonite slurry. Inside the plant, the core holes drilled through the cement floor will be neatly sealed with a cement/sand mixture to floor level.

Degreasing Areas

The former and present degreasing areas represent the most likely source of volatile organic contamination at the site. An investigative program has been developed to sample suspect areas at both of these locations. Seven borings are proposed for these two areas; six for the former degreasing area and one outside of the present small parts degreasing area. Boring locations are shown in Figure 4-1.

The present degreasing area warrants only one sample location based on its relatively small size and the nature of the degreasing operation being conducted at this location (the cleaning of small mechanical parts in a 600-gallon stainless steel tank). The sample boring in this area will occur immediately outside of the building from the degreasing tank where waste solvents were transferred into 55-gallon drums. Samples at this location will be taken by split-spoon sampling using a small geotechnical drill rig.

Drilling inside the former degreasing area will also be conducted with a small geotechnical drill rig capable of taking split-spoon samples.

Of the six borings to be drilled in this area, four (SS-10 to SS-13) will be drilled in the area where the meat display cases were set to drain (along the monorail crane track), as discussed in Section 2.1.1. The remaining two (SS-14 and SS-15) will be drilled, as shown in Figure 4-1, to determine if large-scale spillage may have occurred within the former degreasing area.

Samples at these seven locations will be taken on a continuous basis to the top of competent bedrock with selected intervals sent for laboratory analysis. All of the collected samples will be placed in laboratory-certified clean jars and headspace readings of the samples will be obtained with an OVA to determine the presence or absence of volatile compounds. It is anticipated that of these samples, 12 will be selected for HSL volatile organic analyses based on OVA readings. The selected samples will be packed on ice and shipped to a qualified laboratory. Chain-of-custody requirements will be strictly adhered to during all phases of sample acquisition, handling, and shipping. All remaining samples will be retained for possible future reference (e.g., physical characterization) and will not be available for volatile organics laboratory analysis. The sample borings will be logged by an experienced geologist. All borings will be sealed with a cement/bentonite slurry upon completion of drilling activities.

Task 5 - Hydrogeologic Investigation

The hydrogeologic investigation will focus on plume delineation and ground water recovery potential. In addition, an exploratory program is proposed to define aquifer characteristics as they pertain to the various lithologies present. Specific data to be obtained from the exploratory program will include fracture density, identification of water-producing zones, and relative permeabilities of the various lithologies. In addition, perched water table conditions will be identified where they occur. Monitoring well and exploratory boring locations are shown in Figure 4-2.

Exploratory Drilling

One exploration borehole (E-1) will be cored in an area of investigation to a depth of approximately 220 feet to observe lithologic and fracture characteristics of the shale, siltstone, and fanglomerate occurring in the site vicinity. Drilling will proceed by either the wireline coring or by conventional coring methods. Either air or potable water can be used as the drilling medium. If water is used, the borehole will be purged frequently during drilling so that accurate water level measurements are obtained as drilling progresses. If a perched water table is encountered above the main aquifer, it will be temporarily cased off before drilling proceeds.

Upon completion of drilling, the borehole will be logged by downhole geophysical methods to further define water-producing zones and to provide insight into contaminant transport within the aquifer. A comprehensive suite of logs will be run including gamma, neutron, resistivity, temperature, gamma-gamma, fluid conductivity, and caliper. After logging, the borehole will be sealed to ground surface with a cement/bentonite slurry.

Drilling and Monitoring Well Installation

After completion of the exploratory phase and a review of the static/dynamic conditions occurring within the aquifer, a monitoring well network will be installed to delineate plume boundaries. The monitoring network will include two deep wells drilled to a depth of approximately 220 feet, seven wells drilled to an intermediate depth of 120 to 140 feet, and four shallow wells drilled to a depth of approximately 50 feet. In the event that perched water is encountered, additional shallow wells may be installed to monitor the perched zone. The number of wells installed will be determined by the proximity of the perched water table to the suspected source area of contamination. This decision will be made as drilling progresses and will involve consultation with Remcor technical staff.

The monitoring well network is designed to determine the horizontal and vertical distribution of contamination as a result of aquifer and pumping conditions. To this end, three cluster locations are proposed to monitor the shallow and intermediate depths of the aquifer. In addition, at location 87-10, a cluster consisting of an intermediate and deep well will be drilled; these wells will be compared to the nearby hand-dug well on the Gehman property to provide a vertical distribution of the shallow, intermediate, and deep portions of the aquifer in this area. Also, an intermediate well will be drilled at location 86-4 to complement the existing shallow well to provide a cluster location close to the apparent source area of contamination. In all, a total of seven (including existing locations) cluster locations will exist within the site vicinity after completion of the hydrogeologic investigation.

In addition to the cluster locations, two outlying intermediate wells (87-6I and 87-8I) will be drilled north and west of the site to define plume boundaries, and a shallow well (87-13S) will be drilled in the former degreasing tank area to monitor existing concentrations at this suspected source location. Table 4-2 summarizes the rationale for each proposed well location.

The deep wells will be drilled by air rotary methods. Typical construction is shown in Figure 4-3. These wells will be constructed as open boreholes. Six-inch steel casing will be set and grouted to seal off the upper portion of the aquifer. Casing will typically extend to a depth of approximately 150 feet. A 5-5/8-inch diameter borehole will extend beneath the casing for the well's total depth, which will be dependent upon intercepting water-producing fractures.

The intermediate wells will be installed in a similar manner as the deep wells, except that six-inch casing will be set and grouted at a 60- to 70-foot level. The well's total depth will range between 120 and 140 feet.

The shallow monitoring wells will be drilled into the upper 20 feet of the aquifer to monitor shallow ground water contamination and to assess vertical migration of contaminants throughout the aquifer. Two-inch diameter PVC wells are proposed for areas where the water table is encountered in unconsolidated material. Screen placement will be dependent upon the encountered hydrogeologic conditions (i.e., phreatic or confined); a 10-foot interval will be screened so that the sample will represent a discrete zone, representative of the upper portion of the aquifer. The screened interval will coincide with the encountered water producing zone. The screened interval will not extend above the piezometric surface, based on the characteristics of the contaminants of concern (TCE, DCE).

The PVC screen and riser will be installed through a temporary casing with an inside diameter at least four inches greater than the well pipe. A sand pack will be emplaced around the well screen and up to five feet above it. A bentonite pellet seal will be placed atop the sand pack. The seal will be a minimum of two feet thick and will extend to the static water table. A cement/bentonite slurry will fill the remainder of the annulus to ground surface. Well construction details are depicted in Figure 4-3.

Shallow monitoring wells that encounter ground water in bedrock will either be constructed of two-inch PVC screen and riser or as open boreholes, depending upon the competency of the rock. Wells constructed of two-inch PVC screen and riser will follow the same procedure outlined for shallow wells installed in unconsolidated formations.

If bedrock is competent, the water table wells will be installed as open boreholes of 5-5/8 inches in diameter. Six-inch steel casing will be set and grouted to the top of bedrock in this instance. The open section of the well will extend 15 to 20 feet beneath the stabilized water level. The length of this interval will be dependent upon the encountered hydrogeologic conditions (i.e., phreatic or confined state) and will represent water producing fracture zones in the upper portion of the aquifer.

All wells will have locking protective caps to restrict intentional access and vandalism. Depending on the well location and the wishes of the property owner, the protective caps will extend a short distance above ground surface or will be installed flush with ground surface.

All open borehole wells will be developed by submersible pump to remove turbidity and to ensure that the well is functioning properly. Two-inch PVC wells will be developed by bailing or air-lift methods.

All wells will be located horizontally and vertically by survey after installation so that ground water flow direction(s) can be accurately assessed. Water level measurements will be taken of the newly installed and existing monitoring wells frequently (at least once per week) throughout the investigation.

Aqueous Environmental Sampling

All monitoring wells and the existing BES plant well will be sampled one week after well development is completed. Three to five well volumes of water will be purged from each well before sampling. Measurements of pH and conductivity will be taken periodically during well purging. Purging of the wells may include use of a submersible pump, suction pump, and bailers depending on such factors as depth to water table, diameter of well, and volume to be purged. All purging equipment will be decontaminated by pressurized steam.

All wells will be sampled with dedicated, laboratory-certified clean, stainless steel or Teflon bailers. All wells will be sampled and analyzed for CLP volatile organic compounds. Sample logging and chain-of-custody procedures will be strictly adhered to during all phases of sample acquisition, handling, and shipping. At this time, 24 samples are anticipated. This number includes quality control samples.

In addition to the monitoring wells, all 13 residential/municipal/industrial wells sampled during the ERM Phase II RI hydrogeologic investigation will again be sampled and analyzed CLP for volatile organics. Samples from Municipal Well Nos. 1 and 3 will also be analyzed for ABN organics. Replicate samples of surface water will be collected at a single location within the wetland immediately north of the BES plant. These samples will be analyzed for CLP volatile organics. Water supply wells will be sampled at the closest tap to the pump outlet. The system will be purged for 5 to 10 minutes before sampling; pH and conductivity measurements will be taken during purging to ensure that formation water will be sampled. Sample logging and chain-of-custody procedures will be strictly adhered to throughout sample acquisition, handling, and shipping.

Aquifer Performance Testing

An aquifer pumping test is proposed to determine ground water recovery potential. The well chosen for the test will exhibit relatively good yield and will have a sufficient monitoring network surrounding it so that the geometry of the zone of influence can be accurately determined. The configuration of the zone of influence is critical in determining the most efficient recovery method. The zone may take on a radial shape or it can be elongated or elliptical, depending on dominant fracture systems or secondary permeability along bedding planes.

With presently available data, Bally Well No. 3 appears to be a suitable pumping well, based on its depth, yield, location, and existing and proposed observation well network. The specific pumping location will be determined after installation of the monitoring well network and a review of aquifer conditions.

All outside interference from nearby wells will be minimized by conducting the tests during the most opportune time period and by appealing to nearby well owners to minimize withdrawal during the test period.

Initially, a step drawdown test will be conducted to determine the most favored pumping rate. This test consists of pumping the well at successively higher pumping rates for a short duration (one to two hours) and recording the drawdown or step for each rate. At least five steps will be used and the water level will be permitted to recover to static conditions after each step.

After determination of an effective pumping rate, a long-term pumping test will begin. The test length will depend upon the cone of influence created, but pumping will continue for at least 48 hours, with a water level recovery period nearly as long. During this time, water levels will be recorded at the pumping and all of the observation wells. Pressure transducers coupled to data recorders will be utilized to obtain constant measurements of the pumping and nearest observation wells. Outlying wells will be measured manually with an electronic water level indicator.

If required, Remcor will collect discharge water and perform needed treatment (consistent with prior practices) to remove dissolved volatile organics prior to discharge.

Upon completion of the test, the data will be analyzed using the Jacob straight-line approximation. The data generated will be sufficient to determine an efficient ground water recovery system.

Task 6 - Site Investigation Analysis

All data obtained during the remedial investigation will be evaluated as to its quality and quantity to ensure that an adequate data base is available to support a feasibility study. Data from all site investigations will be organized and presented logically so that relationships between the source area and all affected media (i.e., ground water) are apparent. Hydrogeologic data include those from the Baseline Ground Water Survey (Task 3), exploratory boring and geophysical logging, monitoring well installation, and aquifer performance testing. Analytical data will be obtained from the Source Characterization (Task 4) and ground water sampling activities. All chemical analytical results will be validated in accordance with the Functional Guidelines for Evaluating Organics Analyses (EPA, April 1985).

A summary of the type and extent of contamination will be prepared, including ambient concentrations as a comparison. The number and location of affected residents will be determined and specified. Based on the RI results, an assessment of public health and environmental concerns will be prepared in accordance with the Draft Superfund Exposure Assessment Manual (Versar, Inc., January 14, 1986), and the Superfund Public Health Evaluation Manual (EPA, October 1986).

Task 7 - Remedial Investigation Report

Upon the completion of field remedial investigation activities, the data generated will be reduced and evaluated. From these data, a draft RI report will be prepared summarizing the investigation and its findings. The RI report will include:

- Site background information
- A description of and methodologies for all site investigation activities
- Detailed geologic and hydrogeologic evaluation
- Delineation of potential sources of contamination
- Contaminants of concern
- Physical characteristics of identified contaminants
- Probable environmental fate and transport of contaminants
- Public health and environmental concerns
- Supporting tables, graphics, and appendices, as required, to provide a complete summary of the RI study.

The report will be submitted to EPA Region III for review. After receipt of the review comments from the EPA, a final report will be prepared in concert with the final FS report (Task 14) and submitted to the EPA.

4.2.2 Feasibility Study

The feasibility study is a step-by-step process of incorporating available remedial technologies into remedial alternatives that are designed to minimize or eliminate impacts of the site to public health and the environment. The developed remedial alternatives are then evaluated and compared to each other; the goal of the study is to present and discuss all of the considered alternatives and to choose the most cost-effective alternative that is technically feasible, reliable, implementable, and adequately protects public health and the environment. The feasibility study process and report will follow the guidelines established by the EPA in the June 1985 edition of "Guidance on Feasibility Studies Under CERCLA," and more recent guidance on SARA Section 121. Draft Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites (EPA, October 1986) will be consulted in developing remedial action alternatives. All technologies and remedial alternatives considered, but eliminated during the evaluation and screening process, will be documented in the feasibility study report, describing the rationale for elimination. As discussed in Chapter 3.0 of this Work Plan, the FS will focus on actions necessary to enhance remediation of the aquifer and mitigation of any public health or environmental effects which remain after implementation of wellhead treatment at Bally Well No. 3.

Task 8 - Description of Proposed Response

Based on the results of the RI and site background data, the cleanup objectives for remedial action will be defined. These objectives will address all affected media as they relate to public health and environmental concerns and will be consistent with all identified ARARs.

This effort will be ongoing through the course of the RI/FS, building on the preliminary objectives developed in this work plan (Chapter 3.0) as additional site characterization data are obtained.

Based on existing data, the focus of response actions at the BES site will be on aquifer restoration through ground water renovation. Actions may also include the following:

- Waste containment
- Waste removal (partial or complete)
- Alternative drinking water supplies
- No action.

Task 9 - Identify and Evaluate Remedial Technologies

Remedial technologies that are designed to achieve the general response activities defined in Task 8 will be identified and evaluated. As part of the evaluation process, existing site conditions and waste characteristics will be reviewed to identify conditions that may limit or promote the use of certain technologies. In addition, the performance record of the identified technologies will be reviewed so that unreliable or untested technologies will not receive further consideration. This evaluation process will be performed by a small team of senior Remcor personnel highly experienced in remedial action design and implementation.

Task 10 - Development of Alternatives

All remediation technologies that have passed the initial development process in Task 9 can be used to formulate alternatives for remedial action. Where appropriate, an alternative can be a combination of remedial technologies. All relevant and applicable standards pertaining to site cleanup will be reviewed during development of remedial alternatives.

Based on current EPA guidelines, at least one alternative for each of the following must be evaluated and presented:

- Alternatives for treatment or disposal at an EPA-approved off-site facility

- Alternatives which attain applicable and relevant federal public health or environmental standards
- Alternatives which exceed applicable and relevant public health or environmental standards
- Alternatives which do not attain applicable or relevant public health or environmental standards but will reduce the likelihood of present or future threat from hazardous substances
- A no-action alternative.

Alternatives that do not attain the ARAR public health standards but will not pose a substantial present or potential hazard to human health or the environment will be presented with the rationale used to determine their acceptability. Situations that may warrant this condition include attenuation, degradation, and dilution of contaminants or a demonstration of a lack of exposure from the contaminants.

All remedial alternatives will also be classified as either source control or management of migration actions, or a combination of the two. This development process will again be spearheaded by a team of Remcor's most experienced senior personnel.

Task 11 - Screening of Alternatives

All formulated alternatives will be screened based on environmental and public health criteria and on cost. This task permits an initial assessment of the relative applicability of each alternative.

The environmental and public health screening will rank the remedial alternatives based on their effectiveness in protecting the public health and environment from adverse impacts of the site. Alternatives that do not adequately protect public health and the environment will be eliminated.

Cost screening of the alternatives will be conducted after public health and environmental screening is evaluated. At this stage, alternatives will be considered for elimination where significantly higher cost is not associated with greater environmental or public health benefits or dependability in implementation. The cost screening will be divided into three basic tasks: estimation of costs; present worth analysis; and cost screening evaluation.

Task 12 - Detailed Development and Evaluation of Alternatives

Those alternatives selected from the Task 11 screening as potential remedial actions will be subjected to a detailed evaluation to determine the most cost-effective actions. Initially, sufficient data must be developed regarding each of the screened alternatives to permit thorough evaluation and comparison. The detailed development of each alternative shall include the following:

- A description of the remedial alternative
- Special engineering considerations required for project implementation
- Environmental impacts created by the remedial alternative and methods necessary to mitigate adverse effects
- Operation, maintenance, and monitoring requirements
- Off-site disposal and transportation needs
- Temporary storage requirements
- Safety requirements for remedial implementation
- A description of the potential to phase the remedial alternative into individual operable units or separate areas of remediation.

Once the requirements of each alternative have been developed, a detailed evaluation of each alternative's ability to meet objectives identified for remediation will be conducted. The potential remedial alternatives will be evaluated according to reliability, performance, implementability, safety, and institutional requirements. The alternatives will then be ranked based upon their performance under the various categories. A present-worth cost analysis will then be prepared. Costing procedures will be standardized so that estimates are comparable. Alternatives with lower present-worth costs will be favored.

The performance of a remedial alternative will be evaluated on its effectiveness to prevent or minimize substantial danger to public health, welfare, or the environment and upon its useful life. The effectiveness of the alternative will be determined through design specifications or a performance evaluation. ARARs for public health and the environment will be used when evaluating the effectiveness of an alternative. The effectiveness of the alternative will take into account the physical and locational factors of the site, such as flood potential and climate. The useful life of the alternative will evaluate its projected service life and the resource availability in the future life of the technology.

The reliability evaluation will take into account the alternative's operation and maintenance requirements and the demonstrated performance of the alternative at similar sites or under similar conditions. An estimate of the probability of failure for each component technology and for the complete alternative will be made.

The implementability of the alternative will be evaluated based on the ease of installation (constructibility) and the time required to implement the alternative. Constructibility will take into account the existing site conditions as well as conditions external to the site such as the availability of needed materials or equipment and the acceptability of off-site disposal sites where waste removal is an option. The time required to implement the alternative is, in part, based upon the severity of the existing or potential hazard. Two measures of time that will be addressed are construction time and the time it takes to realize beneficial results of the remedial action.

Safety considerations include those that include short-term and long-term threats to the safety of nearby communities as well as to the workers during implementation. Major risk considerations are fire, explosion, and hazardous substance exposure.

All applicable federal, state, and local standards and other institutional requirements on the design and operation of the alternative will be evaluated to ensure compliance.

Task 13 - Draft Feasibility Study Report

As a result of the evaluation process, the preferred remedial alternative will be identified. This alternative will be the lowest cost alternative that is technically feasible, reliable, implementable, and adequately protects public health and the environment. The remedial action will be selected among those alternatives about which the following four findings can be made:

- Remedies must be protective of human health and the environment.
- Remedies should attain federal and state public health and environmental requirements that have been identified for the site.
- Remedies must be cost-effective.
- Remedies must utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The preferred remedy will represent the best balance across all effectiveness, implementability, and cost factors examined in the detailed analysis.

A draft FS Report will be developed summarizing the results of the remedial alternative development and screening and the detailed evaluation process. This draft report will be submitted to the EPA for review and comment.

Task 14 - Final Remedial Investigation/Feasibility Study Report and Conceptual Design

After incorporation of state and EPA review comments on the draft RI and FS reports, a final report will be prepared summarizing all activities conducted during the RI/FS. This report will summarize the site background; contain the findings of the RI including analytical results, summarize the remedial action evaluation process; present the justification for selection of the chosen remedial action; and contain conceptual design drawings and supporting information. The report will contain all appendices, results, etc., which facilitate further public review or aid in subsequent procurement and contracting.

5.0 PROJECT ORGANIZATION AND SCHEDULE

This section provides information on the Remcor RI/FS project team organization, and the identity of key Remcor team members and subcontractors. It also establishes the schedule for completion of the RI/FS.

5.1 PROJECT ORGANIZATION AND STAFFING

5.1.1 Remcor Organizational Framework

The organizational framework for this project allocates sufficient resources to complete the work in an efficient manner, while providing for a high degree of managerial control.

Figure 5-1 is the proposed organizational chart for this project. As indicated in the figure, there are four levels of direct project responsibility. These are the project director, project manager/project coordinator, principal investigator, and technical staff levels.

The project director will have overall responsibility for Remcor's effort and will be ultimately responsible for the successful completion of the project. The project director is an officer of Remcor fully empowered to procure services, assign resources, and negotiate contracts as needed for effective project execution. The project manager will be responsible for the planning and organization of the day-to-day project activities as well as control of project status (i.e., technical, budget, and schedule). The project manager will be assisted in this effort by a project coordinator. The principal investigators will be responsible for the direction and execution of specific project activities and will be accountable to Remcor's project manager for technical quality, budget, and schedule regarding their area of activity. The technical staff will be assigned specific technical tasks to complete within designated time frames and will be directly supervised by a principal investigator.

The following are brief descriptions of the roles of the key positions and the identity and qualifications of staff members who have been designated to fill the key positions. Resumes of the key personnel are attached in Appendix B.

5.1.2 Project Director

Mr. Leo M. Brausch will be the project director for this project. As director, he will have ultimate responsibility for Remcor's efforts on the project. Mr. Brausch will perform specific functions as follows:

- Assist the project manager in project planning activities
- Attend major scoping and review meetings among Remcor, BES, and EPA
- Coordinate frequently with the project manager on progress in the areas of technical activities, budget, and schedule
- Review all key project documents.

Mr. Brausch is an environmental engineer with 12 years of experience, the past six of which have been directly related to hazardous materials management. Mr. Brausch's technical strength lies in the application of collected site data to the screening and evaluation of alternative remedial action plans for uncontrolled hazardous waste sites.

5.1.3 Project Manager

Mr. John A. George will be the project manager for this effort and will be responsible for the day-to-day management of the project team. He will directly supervise the activities of the principal investigators and serve as the primary liaison between both BES and the regulatory authorities' technical personnel through project completion. Mr. George will work closely with Mr. Brausch in the overall planning of the effort.

Mr. George has had five years of experience in managing and conducting RI/FS assignments on EPA-lead Superfund sites.

Specific responsibilities of the project manager/project coordinator on this project include the following:

- Organizing and scheduling of Remcor technical staff for the work assigned
- Providing technical direction to the principal investigators
- Coordinating subcontractor activities
- Controlling schedules and budgets
- Incorporating the efforts of the technical advisors into the program
- Establishing project records
- Assuring that quality control procedures are followed with respect to field sampling activities and report preparation
- Coordinating with the health and safety personnel for the project
- Participating in project-related meetings
- Review of all project reports.

5.1.4 Project Advisors

As indicated in Figure 5-1, the following individuals will provide key technical input on an advisory basis:

- Ms. Deborah T. Marsh
- Mr. Charles H. Au
- Mr. John F. Winter.

These advisors will participate by providing input to the project manager early in the effort and on an as-needed basis throughout the project. Ms. Marsh has strong background in environmental engineering and expertise in regulatory analysis and alternative remedial action evaluations.

Mr. Au, who is the President of Remcor and a recognized expert in heavy construction, will provide assistance in evaluations of the alternative remedial actions. Mr. Au has over 25 years of technical and managerial experience in earth moving, landfill construction, slurry wall construction, and other environmental-oriented construction projects.

Mr. Winter is the Vice President of Field Projects at Remcor and will provide assistance relative to the cost analysis of the remedial action alternatives. Mr. Winter has five years of experience in the completion of remedial actions at hazardous waste disposal sites and the management of remedial action implementation projects. He has participated in numerous RI/FS projects where his primary activity has been supporting the identification and evaluation of appropriate remedial alternatives.

5.1.5 Quality Assurance/Health and Safety

Ms. Linda K. Scholl will serve in the important project role of quality assurance supervisor and project health and safety officer. Ms. Scholl is a medical scientist with strong technical background in industrial hygiene, risk assessment, and analytical chemistry. Her specific responsibilities include ensuring that a safe working environment exists for all field related tasks. Ms. Scholl will also coordinate all performance and system audits to ensure that QA/QC requirements are met.

5.1.6 Principal Investigators

Because of the variability in expertise and experience necessary in the completion of the RI and FS portions of the project, it will be necessary to have two different individuals fill the principal investigator positions. The primary role of the principal investigators will be to directly supervise and coordinate the activities of the technical staff and subcontractors. The principal investigators will also assist the project manager in monitoring the project schedule and budget.

The RI principal investigator requires a strong background in the design and completion of studies and evaluation of data associated with geologic, hydrogeologic, waste characterization, and other types of field investigative programs. The FS principal investigator requires a strong background in engineering evaluations and design.

Mr. Joseph G. Kasper is the principal investigator for the RI. Mr. Kasper is a geologist with four years of experience dedicated to hazardous waste site evaluation. He is experienced in all aspects of field investigations (e.g., drilling, monitoring well installation, environmental sampling), data interpretation, and remedial investigation report preparation. He has served as the principal investigator for RI/FS studies at several EPA-lead Superfund sites.

Mr. William E. Rosenbaum is the FS principal investigator. Mr. Rosenbaum has five years of experience in environmental engineering related to industrial and hazardous waste management. His experience includes design of industrial waste treatment facilities and engineering studies of municipal water supplies.

5.1.7 Technical Staff

Remcor has a staff of qualified scientists and engineers who will be assigned to the various technical tasks necessary for the completion of the RI/FS. The assigned staff members will work at the direction of the principal investigators in the completion of their assignments.

5.1.8 Laboratory Analysis

All laboratory analysis will be conducted by NUS Corporation of Pittsburgh, Pennsylvania, and EPA Contract Laboratory. All laboratory analyses and quality control procedures will adhere to the EPA CLP Statement of Work. The work will be under the direction of Ms. Peg Marple, laboratory manager. The laboratory's address is as follows:

NUS Corporation
5350 Campbells Run Road
Pittsburgh, PA 15205
412/788-1080

5.1.9 Data Validation

Laboratory data review will be performed by Support Systems, Inc. of Fort Collins, Colorado. The review will be under the direction of Mr. Cary B. Jackson, a chemist with over 12 years of experience in the water, wastewater, and hazardous waste field. Mr. Jackson's resume is included in Appendix B. Support Systems, Inc. has been previously awarded subcontracts to provide data review of EPA CLP analytical results. Their address is as follows:

Support Systems, Inc.
3249 Silverhorne Drive
Fort Collins, CO 80526
303/226-3561

5.1.10 Subcontractor Support

Additional subcontractor support is anticipated for certain tasks of the RI. The subcontractors will be under the direct supervision of the RI principal investigator and project coordinator.

Two drilling firms will be procured to conduct the drilling and monitoring well installation portion of the RI. One firm will be retained to obtain samples for the source characterization task and an additional firm will be contracted to install the proposed monitoring wells and drill the exploratory borehole. Subcontractor selection is currently in progress. Only firms experienced in hazardous waste/ground water contamination studies are being considered. The EPA will be notified immediately upon selection of the drilling subcontractors.

The borehole geophysical logging of the exploratory borehole will be conducted by Appalachian Coal Surveys under the direction of Craig B. Clemmens. Appalachian Coal Surveys have previously conducted logging on numerous Superfund sites in EPA Region III. Data interpretation of the borehole logging will be conducted by Remcor's technical staff.

The borehole logging firm's address is as follows:

Appalachian Coal Surveys
P.O. Box 17203
Pittsburgh, PA 15235
412/243-3039

In addition to the above, the services of a subcontract surveyor will be necessary to obtain accurate location data on monitoring wells and sampling points. The EPA will be notified of the firm that will be conducting the surveying in advance of field activities.

5.2 PROJECT SCHEDULE

Figure 5-2 displays the anticipated project schedule for the BES site RI/FS. The following assumptions have been made in developing this schedule to expedite completion of field phases of the RI prior to the onset of inclement weather:

- EPA approval of the Work Plan, FSAP, HASP, and QAPP will be obtained to permit initiation of the RI within three weeks of plan submittal.
- EPA approval of drilling subcontractors will be completed within two weeks of notification.
- Turnaround of laboratory analyses will be achieved in approximately six weeks.
- Access to drilling locations with the Borough of Bally and acquisition of necessary authorization for the pumping test will not adversely affect the scheduled work.

As shown in Figure 5-2, the Baseline Ground Water Survey (Task 3) will be initiated based on implementation of wellhead treatment at Well No. 3. This is advisable to obtain two weeks of baseline data under present conditions (i.e., Well No. 3 not pumping and minimal pumping of Well No. 1 to supplement the springs).

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TABLES

TABLE 2-1

DAILY WATER CONSUMPTION BY QUARTER
BOROUGH OF BALLY
(1983 to 1987)
BALLY ENGINEERED STRUCTURES SITE RI/FS
(All Values in Gallons Per Day)

YEAR	QUARTER(1) I	II	III	IV
1983	83,571	67,407	84,659	86,802
1984	71,286	70,956	75,747	79,407
1985	84,264	73,659	76,264	79,615
1986	80,033	76,110	83,396	74,945
1987	68,121	-	-	-
Average	77,455	72,033	80,017	80,192

(1) I = January to March
II = April to June
III = July to September
IV = October to December.

SOURCE: Records of the Bally Municipal Water Supply, Bally, Pennsylvania.

TABLE 2-2

PHASE II - MAY 1986 GROUND WATER SAMPLE RESULTS
BALLY ENGINEERED STRUCTURES SITE
(All Results in Parts Per Billion)

WELL NO.	DATE SAMPLED (1986)	TOTAL CHLORINATED VOLATILES	1,1-DICHLOROETHENE	1,1-DICHLOROETHANE	TRANS-1,2 DICHLOROETHENE	CHLOROFORM	1,2-DICHLOROETHANE	1,1,1-TRICHLOROETHANE	TRICHLOROETHENE	TETRACHLOROETHENE
86-1	5/12	–(1)	–	–	–	–	–	–	–	–
86-2	5/13	–	–	–	–	–	–	–	–	–
86-3S	5/12	1,482	170	8	–	–	–	1,300	4	–
86-3D	5/12	670	130	240	–	–	–	210	90	–
86-4	5/13	7,244	570	7	11	7	2	2,300	4,300	47
86-5S	5/12	3	–	–	–	–	–	3	–	–
86-5D	5/12	145	4	–	–	–	–	31	110	–
Plant Site Well	5/13	240	10	–	12	–	–	11	170	37
Farm Products	5/13	–	–	–	–	–	–	–	–	–
Great American Knitting Company	5/13	43	3	–	–	–	–	26	14	–
Bally Ribbon Mill	5/13	39	2	–	–	–	–	27	4	6
G. Smith Residence	5/13	–	–	–	–	–	–	–	–	–
Kehs Brothers	5/13	–	–	–	–	–	–	–	–	–
C. Conrad Residence	5/13	–	–	–	–	–	–	–	–	–
L. Bauer Residence	5/13	–	–	–	–	–	–	–	–	–
Moser Residence	5/13	–	–	–	–	–	–	–	–	–
Gehman Residence	5/14	304	34	–	–	–	–	160	110	–
Longacre Dairy	5/14	–	–	–	–	–	–	–	–	–
Nace Residence	5/14	–	–	–	–	–	–	–	–	–
Municipal Well No. 1	5/14	61	5	–	–	–	–	46	10	–
Municipal Well No. 3	5/14	3,509	360	4	–	1	1	2,500	640	3

(1)"–" indicates none detected.

SOURCE: ERM Phase II RI Report (Funk and Smith, October 27, 1986).

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TABLE 4-1

RI/FS SCOPE OF WORK - TASK DETAIL
BALLY ENGINEERED STRUCTURES SITE
BALLY, PENNSYLVANIA

REMEDIAL INVESTIGATION

TASK NO.	TASK DESCRIPTION
1	Evaluation of the Current Situation
2	Planning and Management
3	Baseline Ground Water Survey
4	Source Characterization
	- Lagoon Areas
	- Degreasing Areas
5	Hydrogeologic Investigation
	- Exploratory Drilling
	- Drilling and Monitoring Well Installation
	- Ground Water Sampling
	- Aquifer Performance Testing
6	Site Investigation Analysis
7	Remedial Investigation Report

FEASIBILITY STUDY

TASK NO.	TASK DESCRIPTION
8	Description of the Proposed Response
9	Identification and Evaluation of Remedial Technologies
10	Development of Alternatives
11	Screening of Alternatives
12	Detailed Development and Evaluation of Alternatives
13	Preliminary Feasibility Study Report
14	Final RI/FS Study Report and Conceptual Design

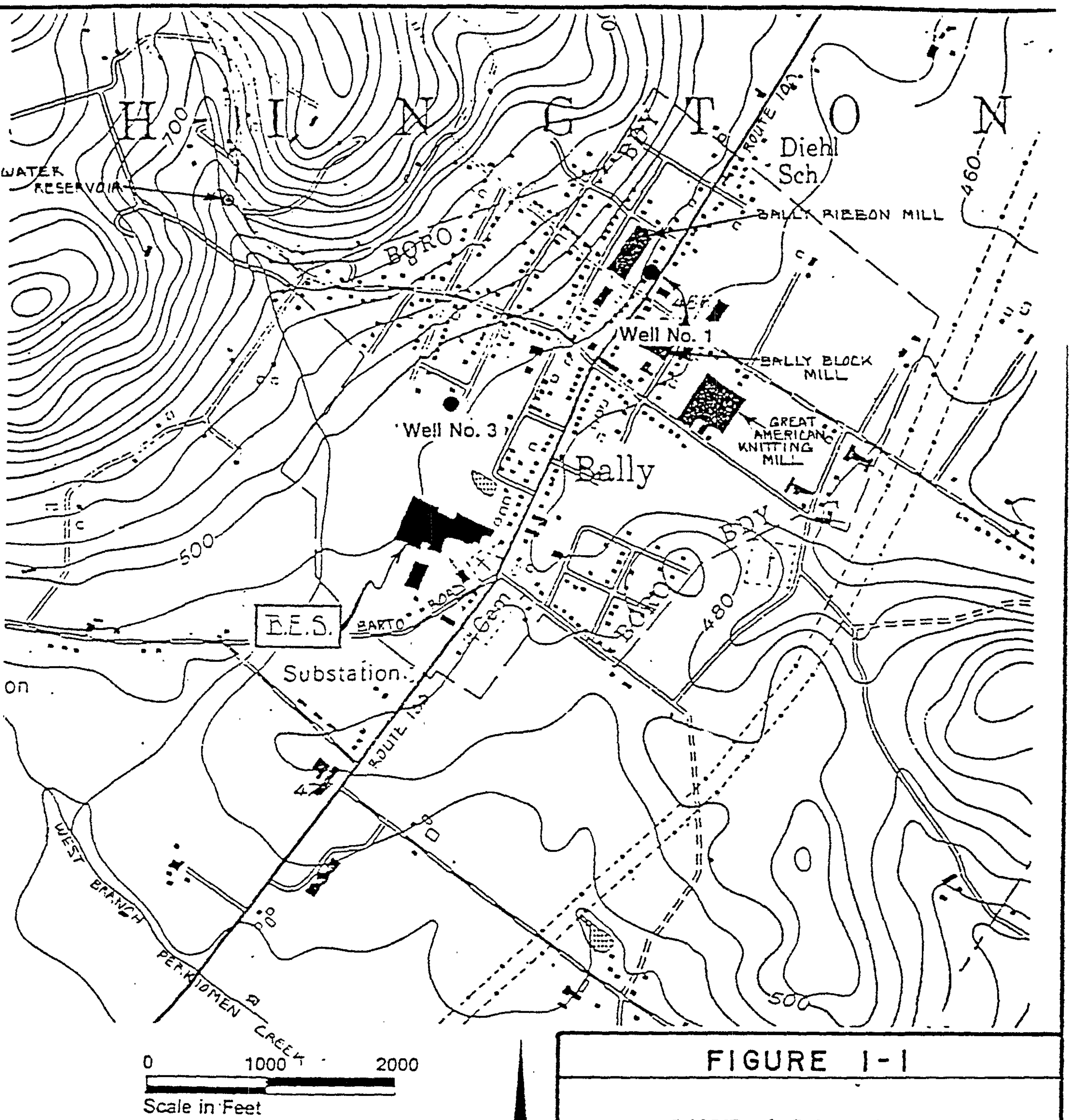
TABLE 4-2

PROPOSED MONITORING WELL SUMMARY
BALLY ENGINEERED STRUCTURES SITE RI/FS

WELL NO.	MONITORED ZONE	PROPOSED DEPTH[(1)] (feet)	RATIONALE
87-4I	Intermediate	120	Determine vertical distribution of plume near source (compare to 86-4S)
87-6I	Intermediate	120	Define extent of plume in northern direction
87-7S 87-7I	Water Table Intermediate	50 120	Determine vertical gradient and distribution of plume between Municipal Well Nos. 1 and 3
87-8I	Intermediate	120	Determine northeast extent of plume
87-9S 87-9I	Water Table Intermediate	50 120	Determine vertical gradient and distribution of plume east of the site
87-10I 87-10D	Intermediate Deep	50 220	Determine plume concentrations downgradient of site (compare to Gehman well)
87-11S 87-11I	Water Table Intermediate	50 120	Determine vertical gradient and distribution of plume in the eastern vicinity of site
87-12D	Deep	220	Determine vertical distribution of contamination near source (compare between 86-3 cluster and Municipal Well No. 3)
87-13S	Water Table	40	Determine concentration of volatile organics in suspected source area

(1) Actual well depth may vary and is dependent on intercepting water producing fractures.

FIGURES



REFERENCE:

U.S.G.S. TOPOGRAPHIC QUADRANGLE EAST GREENVILLE, PENNSYLVANIA.

LEGEND:

● WELL NO. 1 — DENOTES BOROUGH OF BALLY MUNICIPAL WELL

N

FIGURE 1-1

SITE LOCATION MAP

300238

PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

		DRAWING NUMBER
DRAWN	4/14/87 LGL	87313-A5
CHECKED	4/16/87 JAG	
APPROVED	IMB 4/28/87	

REMCOR

AR300238

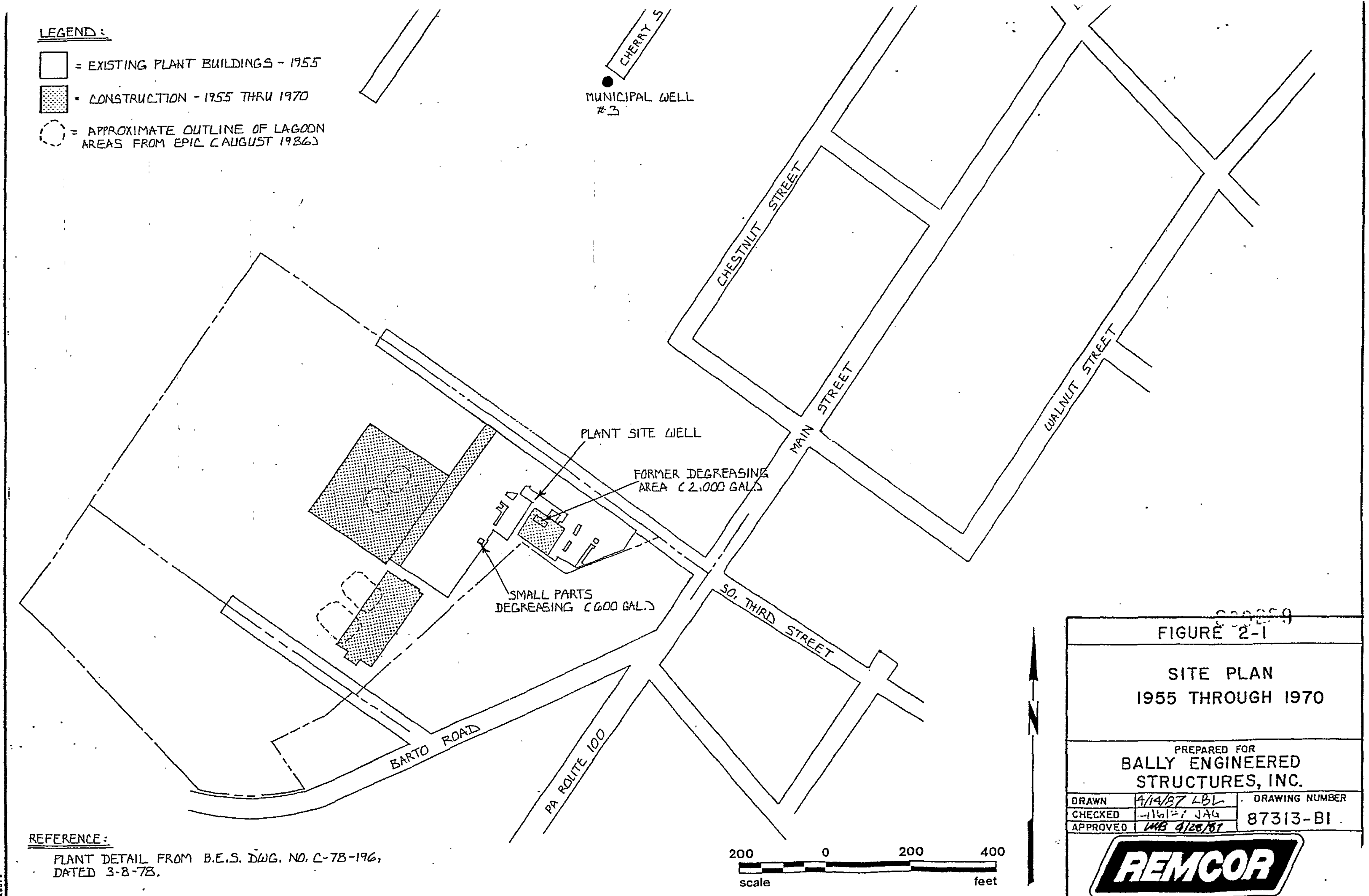


FIGURE 2-1

SITE PLAN
1955 THROUGH 1970

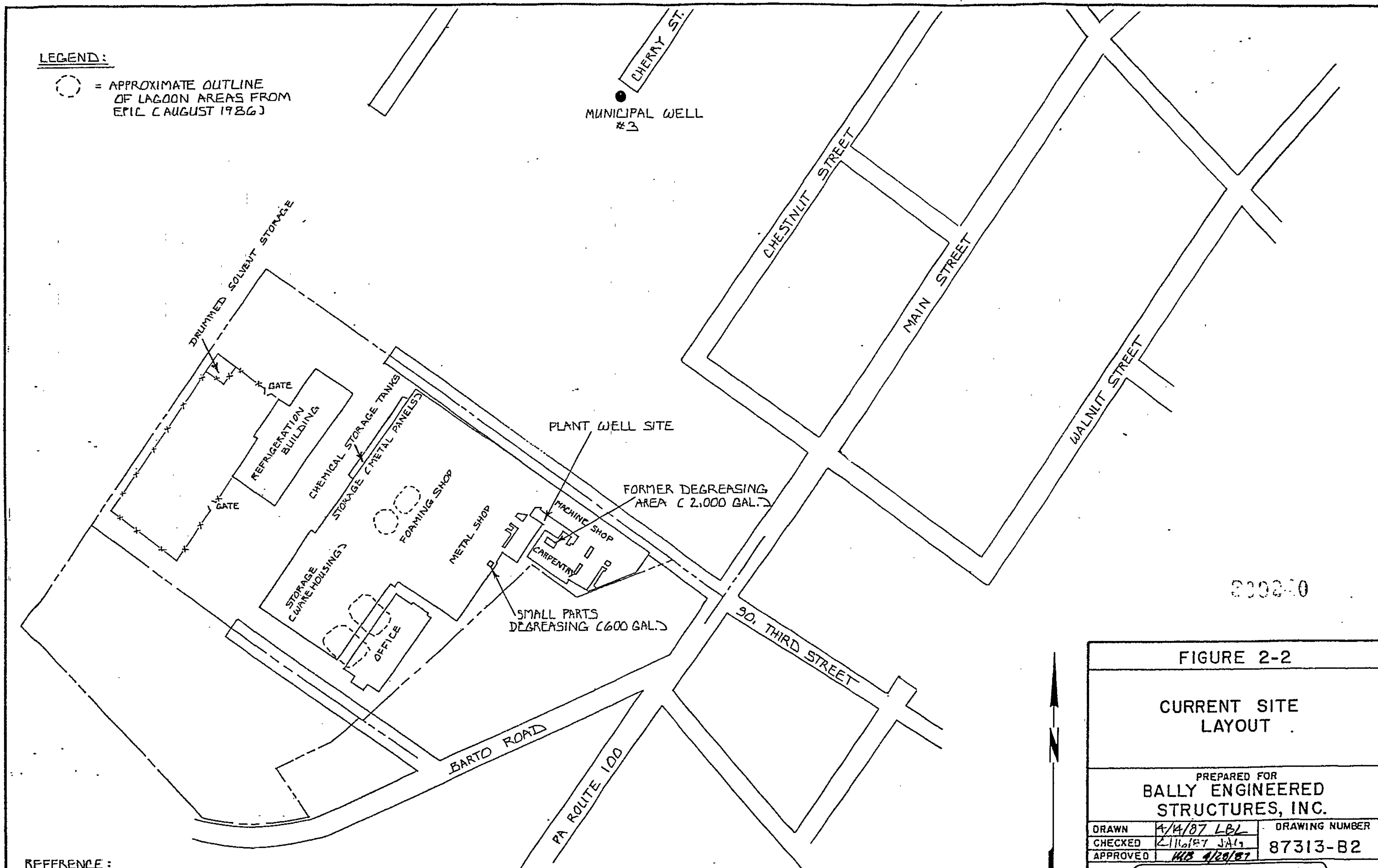
PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	4/14/87 LBL	DRAWING NUMBER
CHECKED	-/16/87 JAG	87313-B1
APPROVED	WB 4/28/87	

REMCOR

REFERENCE:
PLANT DETAIL FROM B.E.S. DWG. NO. C-78-196, DATED 3-8-78.

AR300239



REFERENCE:
PLANT DETAIL FROM B.E.S. DWG. NO. C-78-196, DATED 3-8-78.

FIGURE 2-2

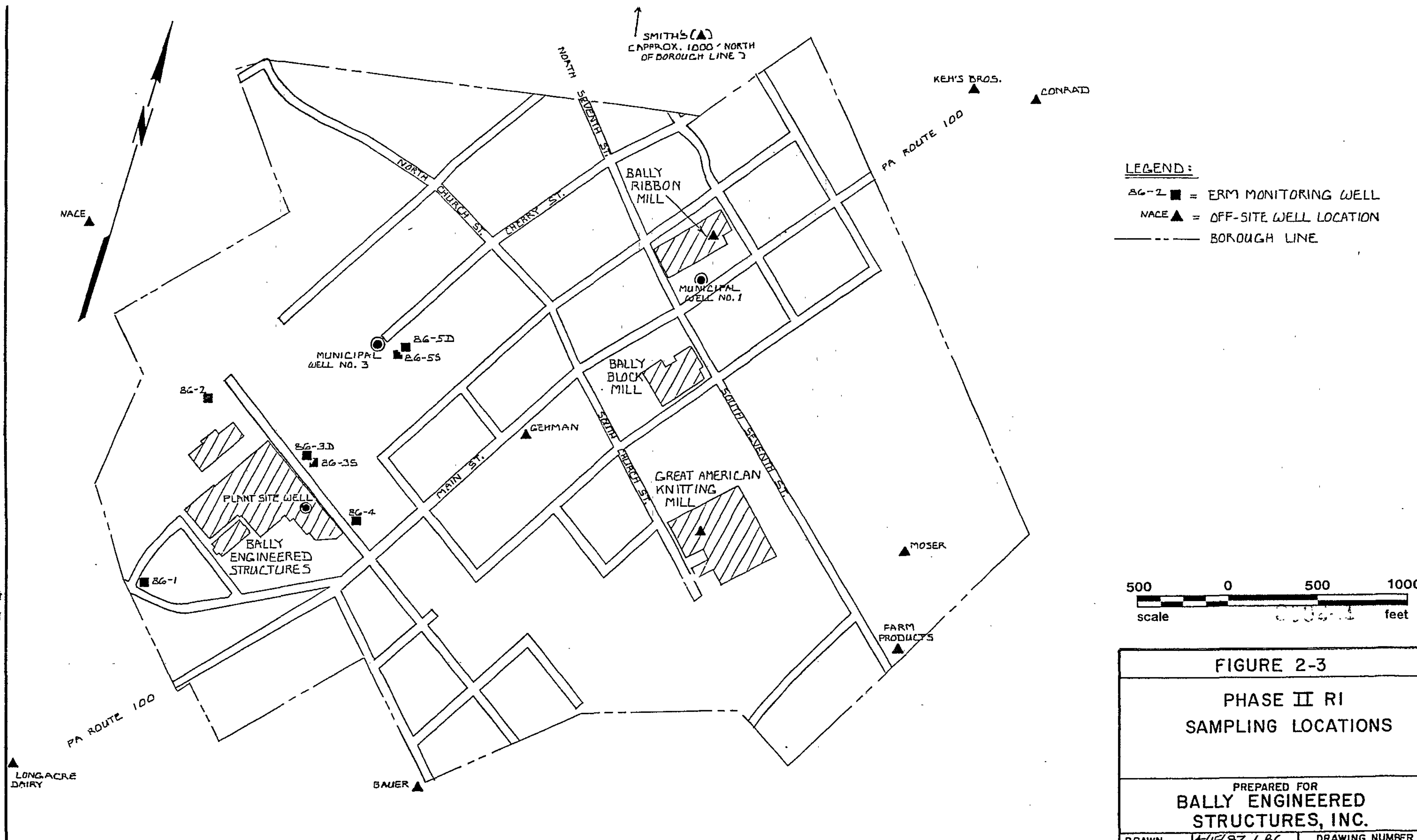
CURRENT SITE LAYOUT

PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	4/14/87 LBL	DRAWING NUMBER
CHECKED	4/16/87 JAG	87313-B2
APPROVED	MB 4/20/87	

REMCOR

AR300240



REFERENCE:

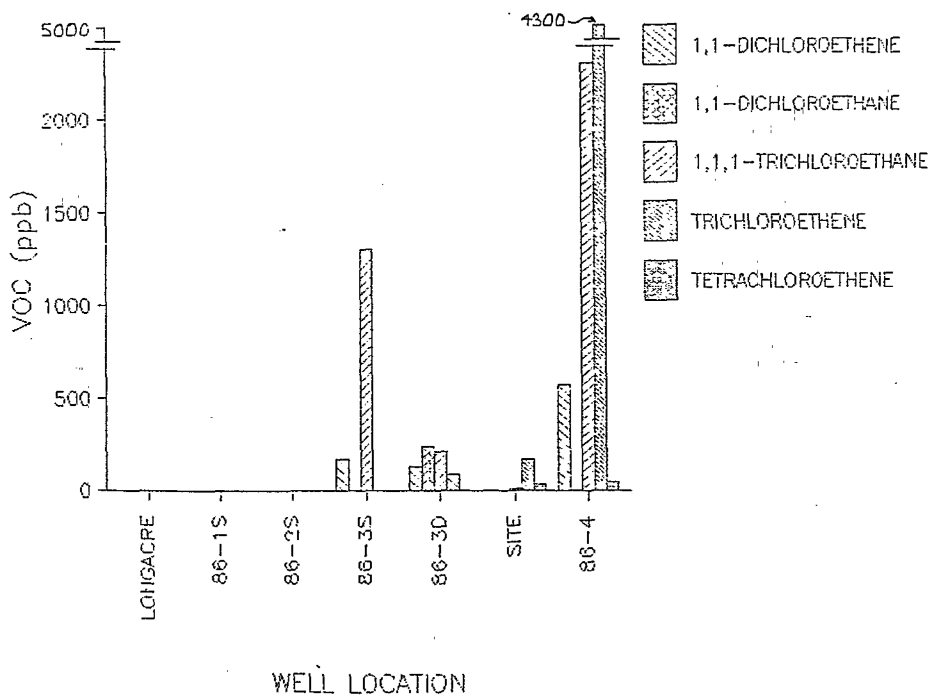
SAMPLE LOCATIONS FROM ERM PHASE II REPORT (FUNK AND SMITH, OCT. 27, 1986), BASE MAP FROM TOPOGRAPHICAL SURVEY, BOROUGH OF BALLY (1975).

FIGURE 2-3	
PHASE II RI SAMPLING LOCATIONS	
PREPARED FOR BALLY ENGINEERED STRUCTURES, INC.	
DRAWN 4/15/87 LBC	DRAWING NUMBER
CHECKED 4/11/87 TAG	87313-B3
APPROVED MB 4/20/87	

REMCOR

AR300241

128579



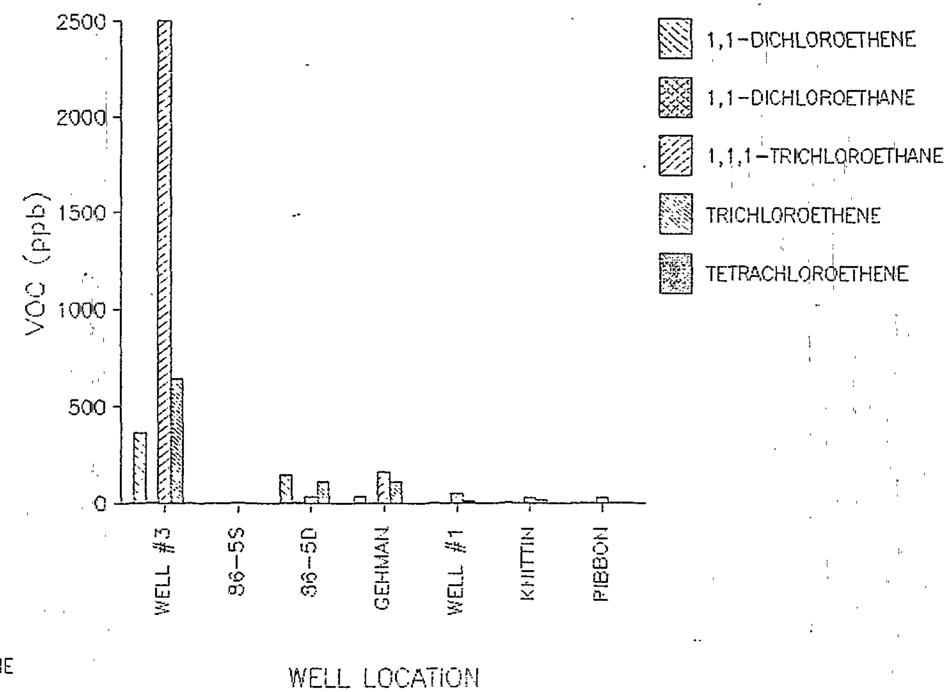


FIGURE 2-4

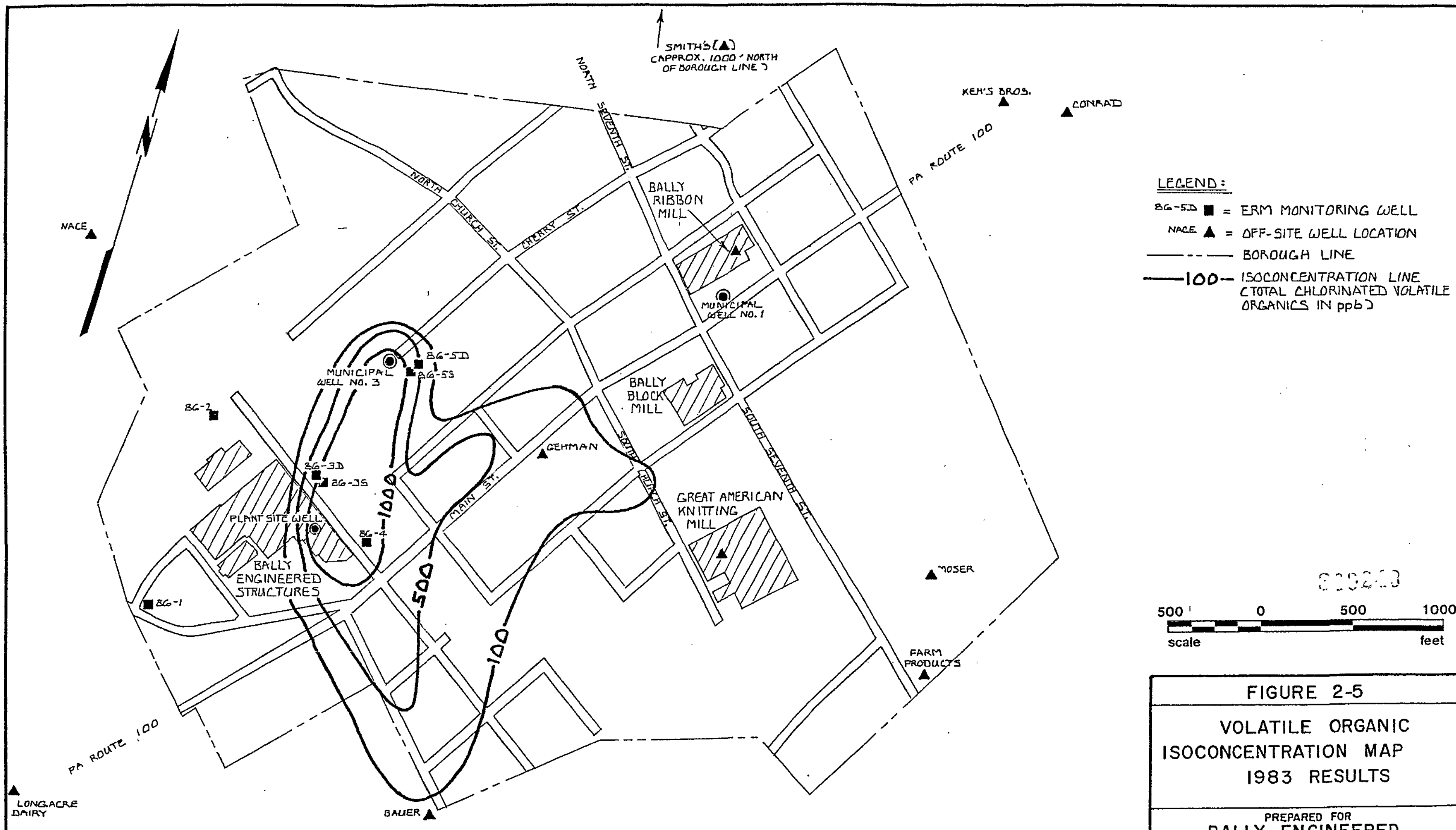
PREDOMINANT VOLATILES IN GROUND WATER 1986 RESULTS

PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	4/16/87 LBL	DRAWING NUMBER
CHECKED	4/16/87 JAG	87313-B9
APPROVED	WB 4/28/87	

REMCOR

AR300242



REFERENCE:
SAMPLE LOCATIONS AND ISOCONCENTRATION DATA FROM ERM PHASE II REPORT (FUNK & SMITH, OCT. 27, 1986).
BASE MAP FROM TOPOGRAPHICAL SURVEY, BOROUGH OF BALLY (1975).

FIGURE 2-5

VOLATILE ORGANIC ISOCONCENTRATION MAP 1983 RESULTS

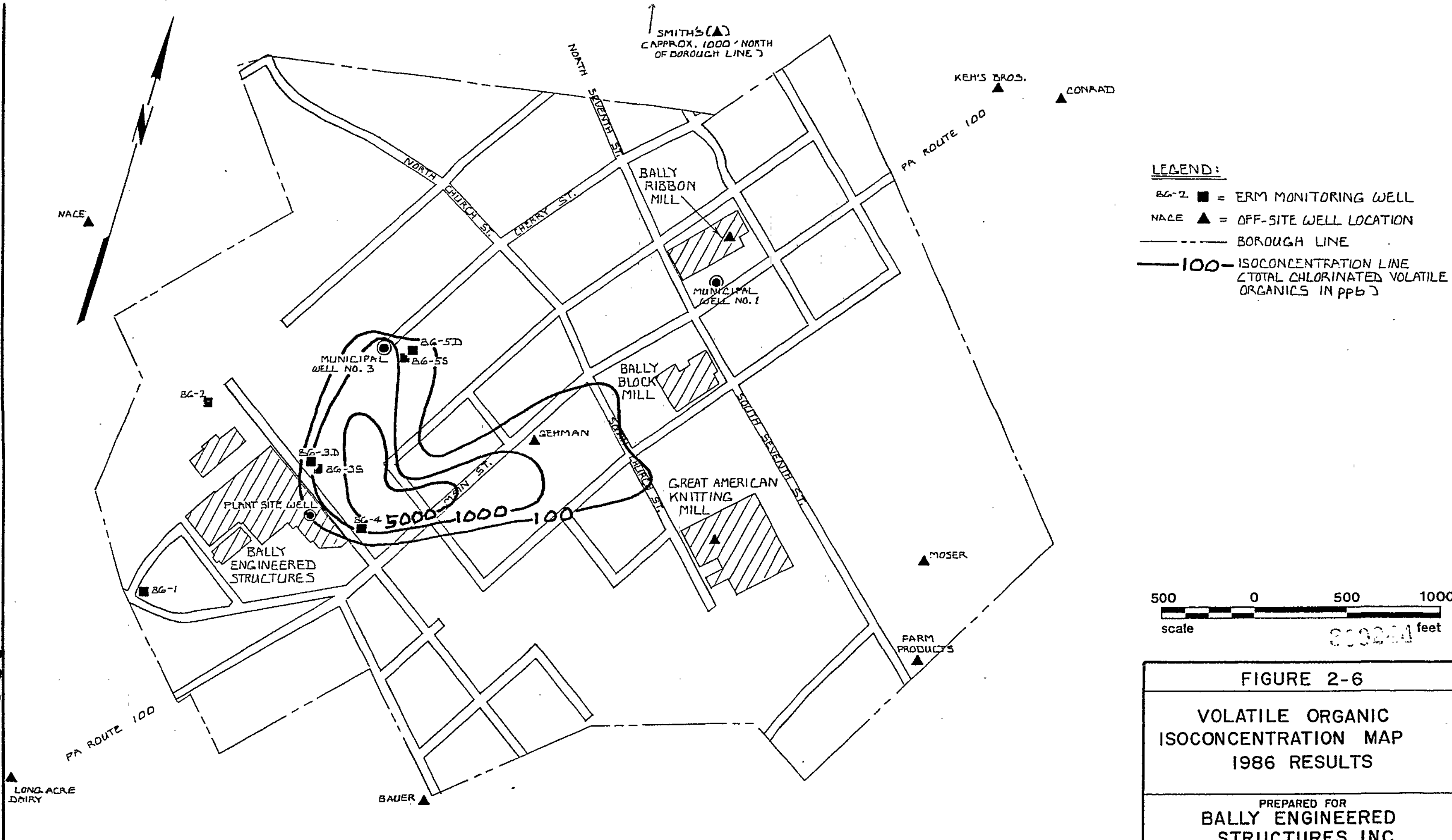
PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	4/15/87 LBL	DRAWING NUMBER
CHECKED	4/16/87 JAG	87313-B5
APPROVED	WB 4/29/87	

REMCOR

128579

AR300243



REFERENCE:
SAMPLE LOCATIONS AND ISOCONCENTRATION DATA FROM ERM PHASE II REPORT (FUNK & SMITH, OCT. 27, 1986).
BASE MAP FROM TOPOGRAPHICAL SURVEY, BOROUGH OF BALLY (1975).

FIGURE 2-6

VOLATILE ORGANIC ISOCONCENTRATION MAP 1986 RESULTS

PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	4/15/87 LEL	DRAWING NUMBER
CHECKED	4/16/87 JAL	87313-B4
APPROVED	WB 4/28/87	

REMCOR

AR300244

128579

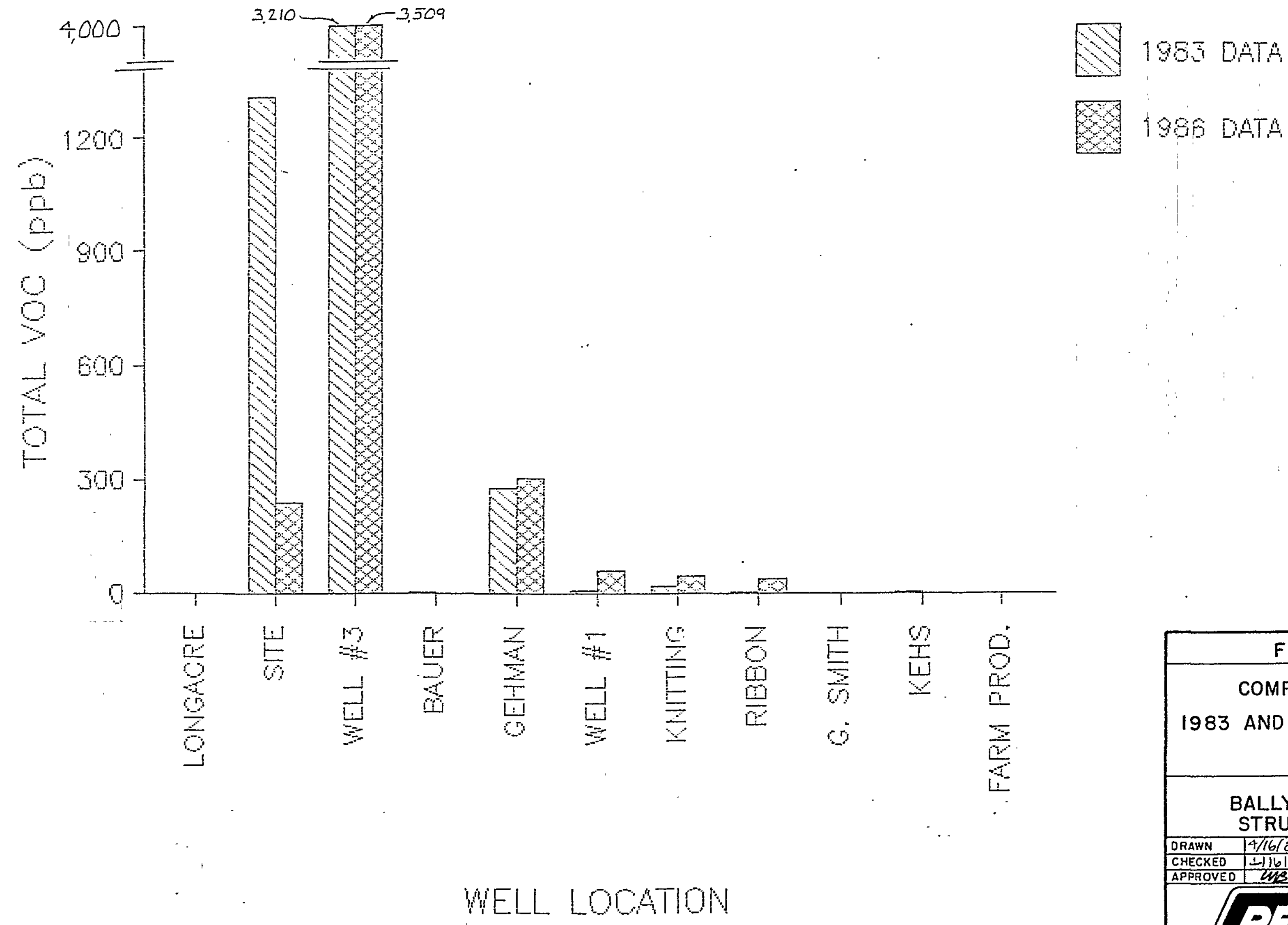


FIGURE 2-7

COMPARISON OF
1983 AND 1986 VOC RESULTS

PREPARED FOR
BALLY ENGINEERED STRUCTURS, INC.

DRAWN	4/16/87 LBL	DRAWING NUMBER
CHECKED	4/16/87 JA	87313-B10
APPROVED	WB 4/29/87	

REMCOR

AR300245

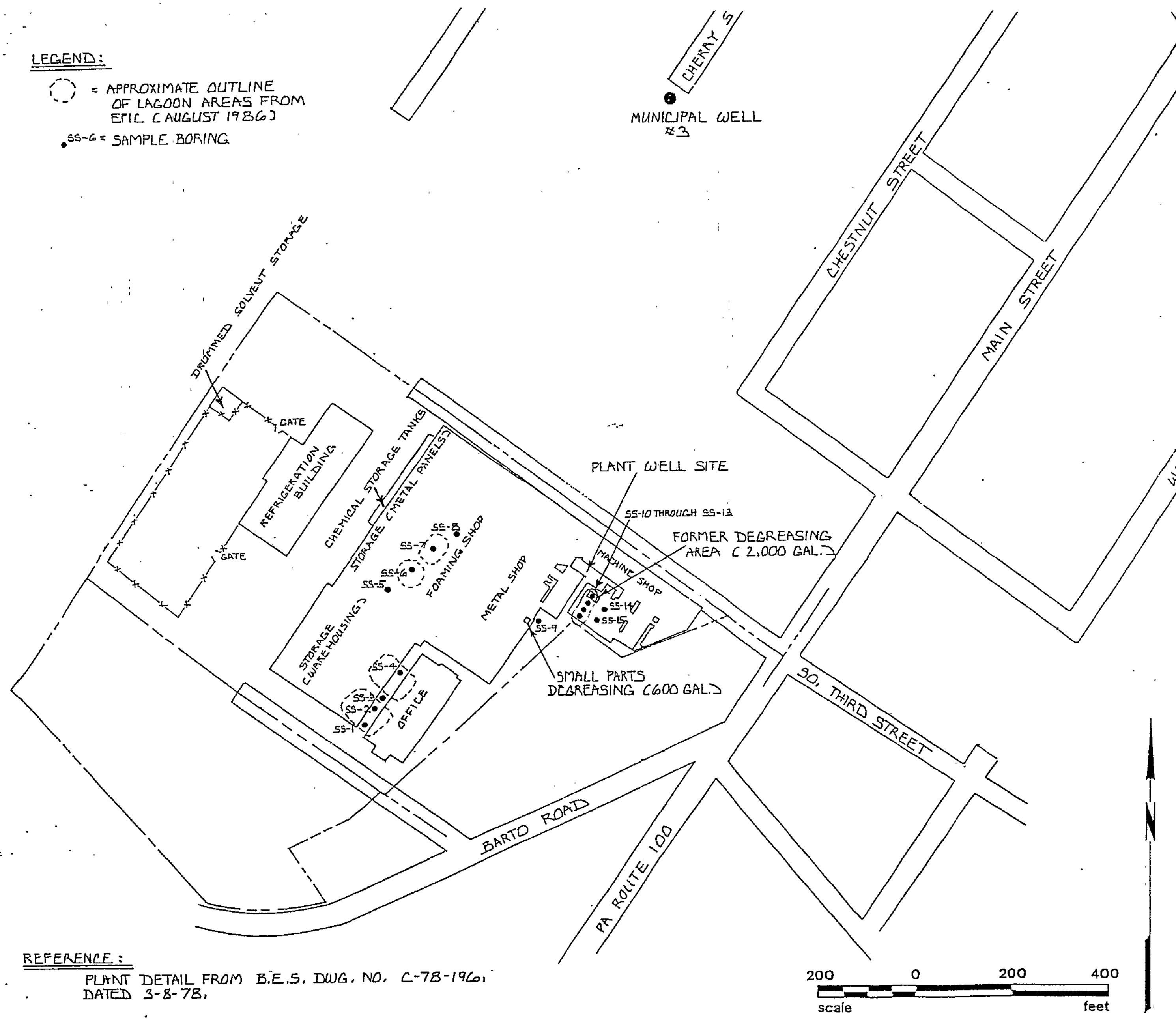


FIGURE 4-1

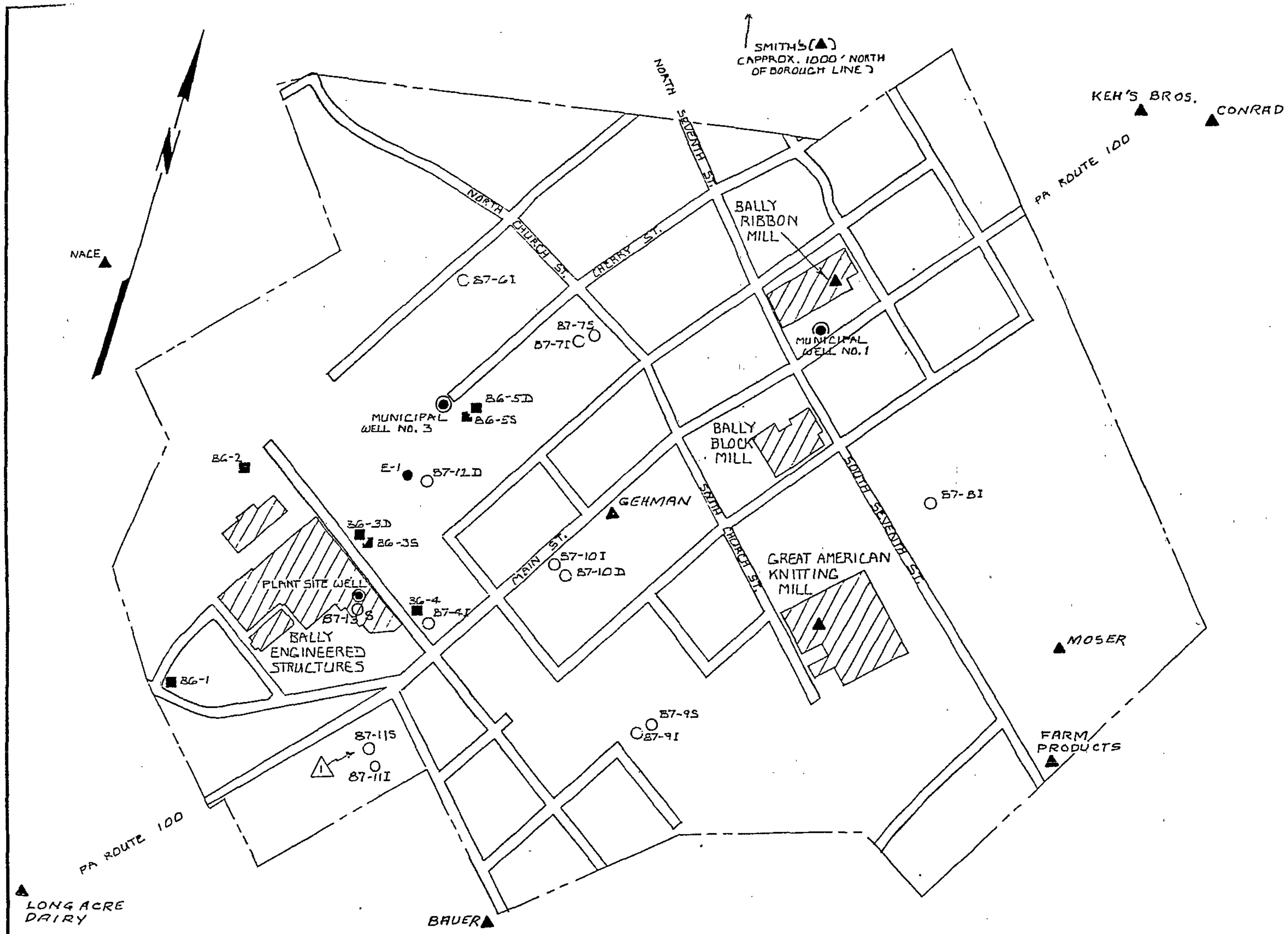
PROPOSED WASTE CHARACTERIZATION SAMPLE LOCATIONS

PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	4/15/87 LBL	DRAWING NUMBER
CHECKED	4-16-87 JAG	87313-B7
APPROVED	WB 4/28/87	

REMCOR

AR300246



LEGEND:

B6-2 ■ = ERM MONITORING WELL

NACE ▲ = OFF SITE WELL LOCATION

— — — BOROUGH LINE

○ B7-10 PROPOSED MONITORING WELL
S = SHALLOW
I = INTERMEDIATE
D = DEEP

● E-1 EXPLORATION CORE HOLE

NOTE:
ERM WELL NOMENCLATURE DOES NOT CORRELATE EXACTLY WITH THAT OF THE PROPOSED WELLS. ERM WELLS B6-1, B6-2, B6-3S, B6-4 AND B6-5S ARE SHALLOW WELLS UNDER THE PROPOSED SYSTEM, WHILE B6-3D AND B6-5D APPROXIMATE INTERMEDIATE DEPTH WELLS.

500 0 500 1000
scale feet

REFERENCE:
SAMPLE LOCATIONS FROM ERM PHASE II REPORT (FUNK AND SMITH, OCT. 27, 1986).
BASE MAP FROM TOPOGRAPHICAL SURVEY, BOROUGH OF BALLY (1975).

FIGURE 4-2

PROPOSED MONITORING WELL LOCATIONS

PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	4/15/97 LBL	DRAWING NUMBER
CHECKED	4/16/97 JAG	87313-B8
APPROVED	MB 4/20/87	

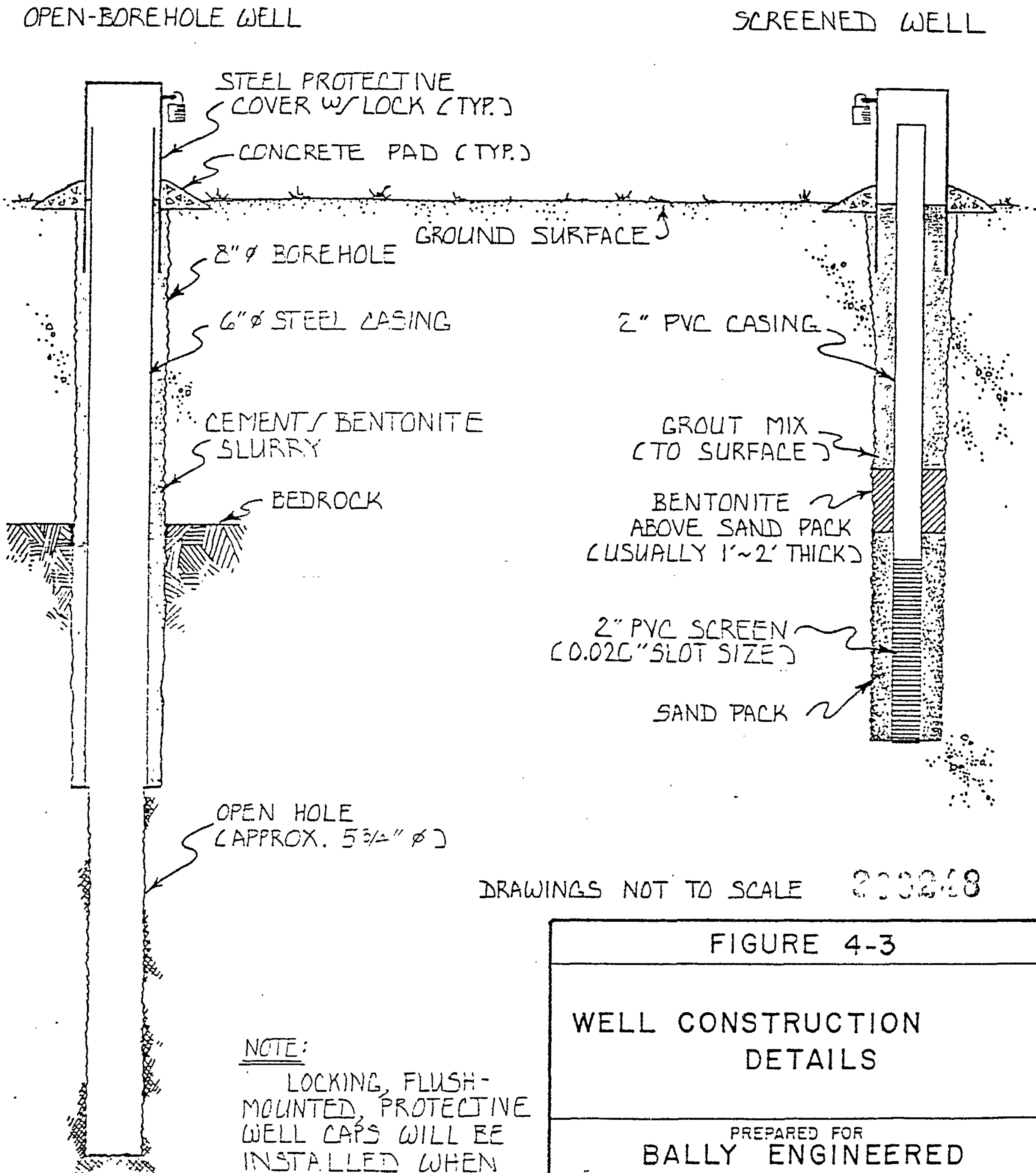
REMCOR

REV. 1

REVS. 1 ○ B7-11S B7-11I RELOCATED RJH 9/11/87

128579

AR300247



DRAWINGS NOT TO SCALE

NOTE:
LOCKING, FLUSH-MOUNTED, PROTECTIVE WELL CAPS WILL BE INSTALLED WHEN CONDITIONS DICTATE THAT A WELL CANNOT EXTEND ABOVE GROUND SURFACE.

FIGURE 4-3

WELL CONSTRUCTION DETAILS

PREPARED FOR
BALLY ENGINEERED STRUCTURES, INC.

DRAWN	2/5/87 LBL	DRAWING NUMBER
CHECKED	2/16/87 JAG	87313-A6
APPROVED	LAB 4/28/87	

REMCOR

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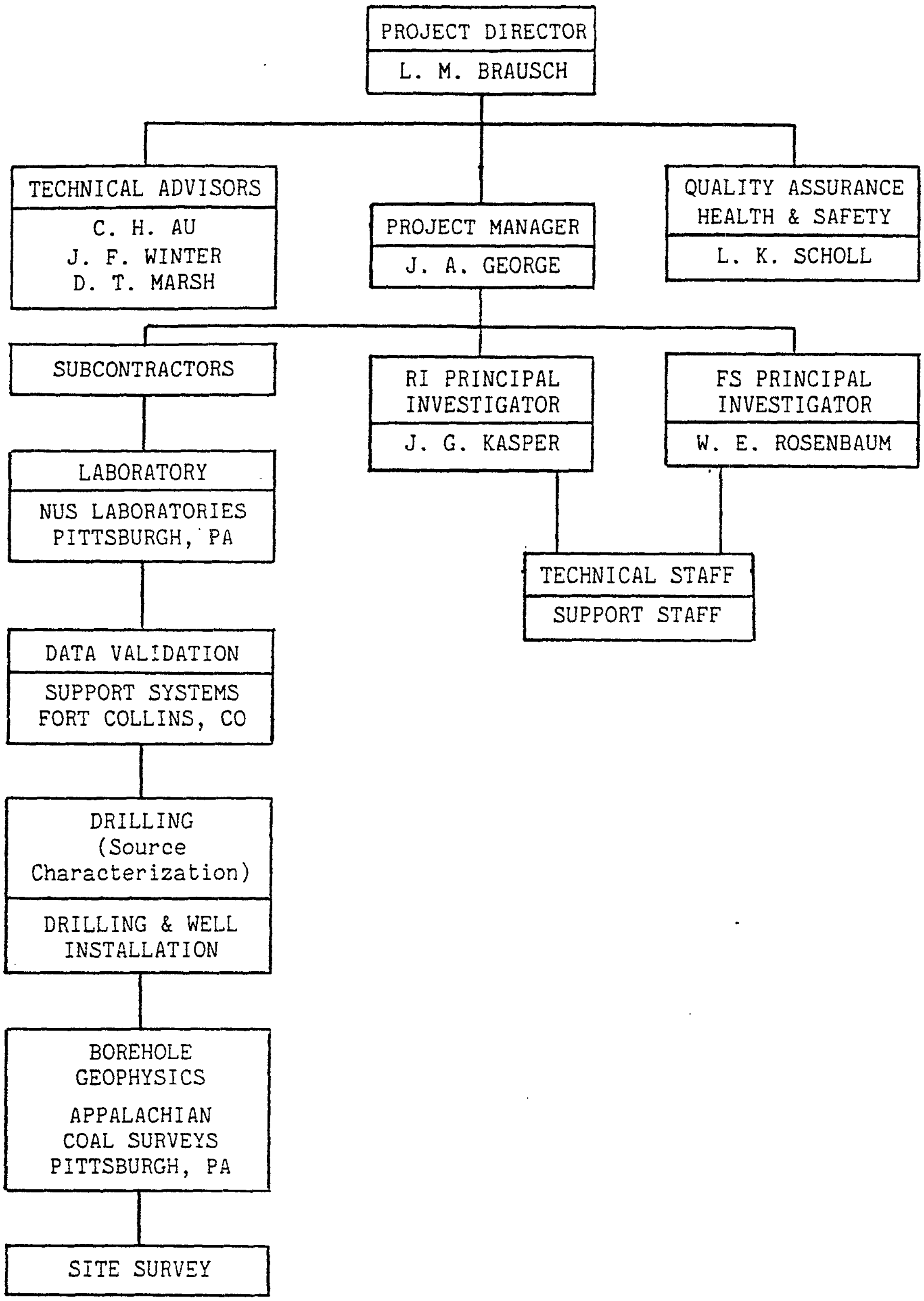
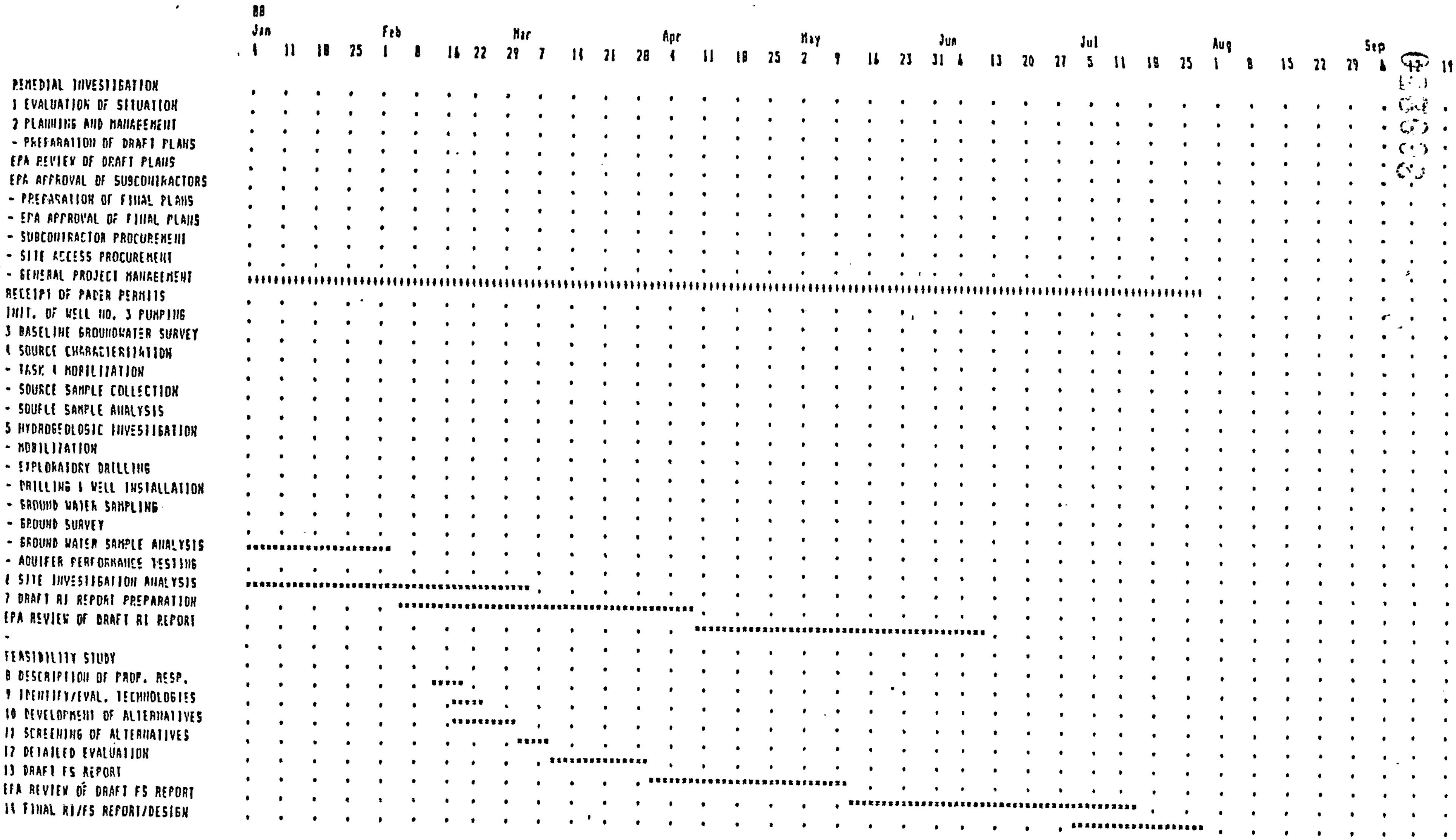


FIGURE 5-1
PROPOSED PROJECT ORGANIZATION



=== Task
+++ Started task
M Milestone

Scale: Each character equals 1 day

FIGURE 5-2

RI/FS SCHEDULE

BALLY ENGINEERED STRUCTURES SITE

SHEET 2 OF 2

AR300250

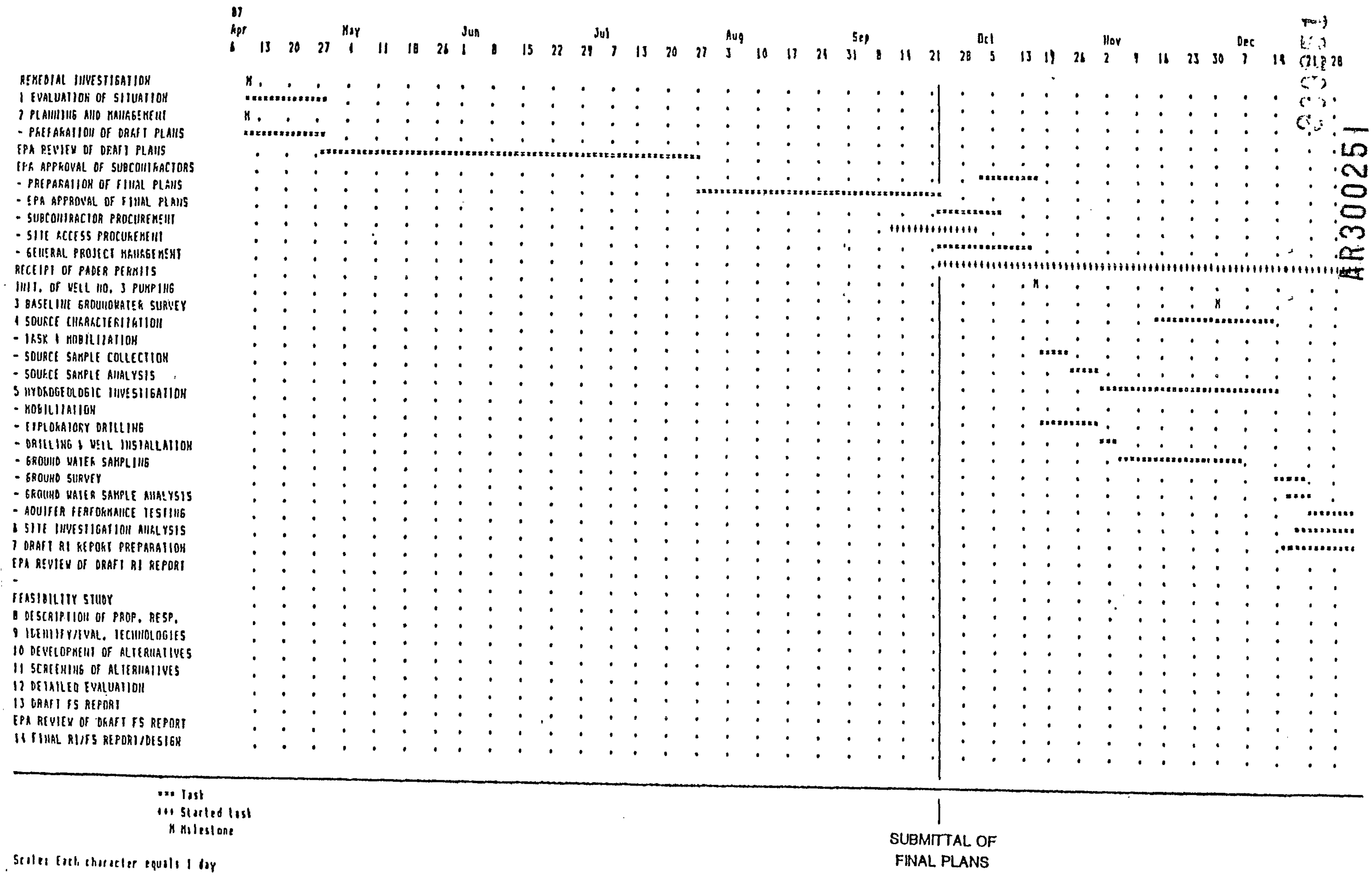


FIGURE 5-2
RI/FS SCHEDULE
BALLY ENGINEERED STRUCTURES SITE

SHEET 1 OF

AR300251

APPENDIX A

MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet

QUICK IDENTIFIER (In Plant Common Name)

Manufacturer's Name	Chemical Solvents, Inc.	Emergency Telephone No.	1-800-321-8506 National 1-800-362-0693 Ohio
Address	3751 Jennings Rd. Cleveland, Oh. 44109	Other Information Calls	(216) 741-9310
Signature of Person Responsible for Preparation		Date Prepared	10/85

SECTION 1 - IDENTITY

Common Name: (used on label) (Trade Name & Synonyms)	SP 711	Cas No.	N/A
Chemical Name	N/A	Chemical Family	Chlorinated hydrocarbons, alcohols
Formula	N/A		

SECTION 2 - HAZARDOUS INGREDIENTS

Principal Hazardous Component(s) (chemical & common name(s))	CAS registry no.	Threshold Limit Value
Trichlorethylene	79-01-6	100 ppm
Methylene Chloride	75-09-2	100 ppm
Methanol	67-56-1	200 ppm
Ethyl Alcohol	64-17-5	100 ppm
Additive	N/A	*N.E.

* NOT ESTABLISHED

SECTION 3 - PHYSICAL & CHEMICAL CHARACTERISTICS (Fire & Explosion Data)

Boiling Point	120 °F	Specific Gravity (H_2O=1)	1.241
Vapor Pressure (mm Hg)	343 @ 20 °C		
Percent Volatile by Volume (%)	100%	Vapor Density (Air = 1)	2.62
Evaporation Rate (ether = 1)	approx. 1.8		
Solubility in Water	Moderate	Reactivity in Water	None
Appearance and Odor	Clear colorless liquid, mild alcoholic smell.		

Flash Point	120 °F closed cup	Flammable Limits in Air % by Volume (Lower / Upper)	unknown
Extinguisher Media	CO_2 dry chemical, foam	Auto-Ignition Temperature	unknown

Special Fire Fighting Procedures: Wear self-contained breathing apparatus.

Unusual Fire and Explosion Hazards: Sealed drums may rupture due to internal pressure. Toxic vapors will be evolved.

AR300253

SECTION 4 - PHYSICAL HAZARDS

Stability Unstable ☐ Stable ☒ Conditions to Avoid Avoid hot surfaces, open flame, electrical arcs.

Incompatability (Materials to Avoid) Strong oxidizers, alkalies or acids.

Hazardous Decomposition Products Oxides of carbon, phosgene (small amounts). Hydrogen chloride

Hazardous Polymerization May Occur ☐ Will Not Occur ☒ Conditions to Avoid None

SECTION 5 - HEALTH HAZARDS

Threshold Limit Value AVG TLV = 100 ppm/8 hrs.

Signs and Symptoms of Exposure 1. Acute Overexposure Depresses the central nervous system.

2. Chronic Overexposure Have caused liver and kidney disease in experimental animals.

Medical Conditions Generally Aggravated by Exposure Acute and chronic liver and kidney disease, chronic lung disease, anemia, coronary disease or rhythm disorders of the heart

Chemical Listed as Carcinogen or Potential Carcinogen Methylene Chloride National Toxicology Program Yes ☒ No ☐ animal I.A.R.C. Monographs Yes ☐ No ☒ OSHA Yes ☐ No ☒

OSHA Permissible Exposure Limit N/A ACGIH Threshold Limit Value N/A Other Exposure Limit Used AVG TLV = 100 ppm/8 hrs.

Emergency and First Aid Procedures

1. Inhalation
Remove to fresh air. Administer oxygen if necessary.

2. Eyes
Flush with water for 15 minutes. Call a physician.

3. Skin
Remove contaminated clothing. Call a physician.

4. Ingestion
Do not induce vomiting. Call physician immediately.

SECTION 6 - SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) None required below PEL (TLV)

Ventilation Normal use Local Exhaust generally unnecessary Mechanical (General) required Special explosion proof Other

Protective Gloves Viton, neoprene gloves Eye Protection Chemical safety goggles. No contact le

Other Protective Clothing or Equipment Apron, boots or headgear if splashing is a problem.

SECTION 7 - SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

Precautions to be Taken in Handling and Storage Avoid contact with skin, breathing of vapors. Pipe vents outdoors. Store in cool, dry, ventilated area. Vapors are heavier than air & will collect in low

Other Precautions Prevent moist air from entering storage. No smoking in pressence of vapors. C with aluminum under pressurizable fluid system may cause violent reactions.

Steps to be Taken in Case Material is Released or Spilled Evacuate area, ventilate, contain spill. Clean area (wear protective gear) by mopping or using absorbent material. Place in sealed container.

Waste Disposal Methods Use licensed reclaimer, incinerator, or waste management facility. Contact Chemical Solvents, Inc.

IMPORTANT
Do not leave any blank spaces. If required information is unavailable, unknown, or does not apply, so indicate.

onic overexposures to methylene chloride have caused liver and kidney disease in experimental animals.

Carcinogenicity: Methylene chloride has been evaluated for possible cancer causing effects in laboratory animals. Inhalation studies at concentrations of 2,000, and 4,000 ppm increased the incidence of malignant liver and lung tumors in mice. Three inhalation studies of rats have shown increased incidence of benign mammary gland tumors in female rats at concentrations of 500 ppm and above and increases in benign mammary gland tumors in males at concentrations of 1,500 ppm and above. Rats exposed to 50 and 200 ppm via inhalation showed no increased incidence of tumors. Mice and rats exposed by ingestion at levels up to 250 mg/kg/day lifetime and hamsters exposed via inhalation to concentrations up to 3,500 ppm lifetime did not show an increased incidence of tumors.

The International Agency for Cancer Research considers liver and lung tumors in mice as limited evidence of animal carcinogenicity. The significance of benign mammary gland tumors is unknown.

Component A has caused increased incidence of nasal tumors in rats exposed by inhalation, forestomach tumors in rats exposed by gavage (forced-fed in oil) and injection site tumors when injected under the skin of rats.

Epidemiology studies of 751 humans chronically exposed to methylene chloride in the workplace for a minimum of 20 years did not demonstrate any increase in deaths caused by cancer or cardiac problems. A second study of 2,227 workers confirmed these results.

Methylene chloride has been identified as animal carcinogen by NTP, but is not on the IARC or OSHA lists, as of August 31, 1985. Component A has been identified as an animal carcinogen by IARC and NTP, but is not on the OSHA list.

Reproductive Toxicity: Reproductive toxicity tests have been conducted to evaluate the potential adverse effects methylene chloride may have on reproduction and offspring of laboratory animals. The results indicate that methylene chloride does not cause birth defects, in laboratory animals.

Material Safety Data Sheet

QUICK IDENTIFIER (In Plant Common Name)

Manufacturer's Name: Chemical Solvents, Inc.

Emergency Telephone No.: 1-800-321-8506 National; 1-800-362-0693 Ohio

Address: 3751 Jennings Rd. Cleveland, Oh. 44109

Other Information Calls: (216) 741-9310

Signature of Person Responsible for Preparation:

Date Prepared:

SECTION 1 - IDENTITY

Common Name: (used on label) (Trade Name & Synonyms): SP 713

Cas No.: N/A

Chemical Name: N/A

Chemical Family: Chlorinated Hydrocarbon, Alcohol, Aromatic

Formula:

SECTION 2 - HAZARDOUS INGREDIENTS

Principal Hazardous Component(s) (chemical & common name(s))	Cas Reg Number	Threshold Limit Value (units)
Toluene	000108883	100 ppm
Methylene Chloride	75-09-2	100 ppm
Methanol	67-56-1	200 ppm
Ethanol	64-17-5	100 ppm
Additive	N/A	*N.E.

*Not Established

SECTION 3 - PHYSICAL & CHEMICAL CHARACTERISTICS (Fire & Explosion Data)

Boiling Point: ~ 120° F

Specific Gravity (H_2O=1): ~ 1.15

Vapor Pressure (mm Hg): ~ 340 @20°C

Percent Volatile by Volume (%): 100%

Vapor Density (Air = 1): Greater than

Evaporation Rate (ether = 1): Slower

Solubility in Water: Moderate

Reactivity in Water:

Appearance and Odor: Clear, Colorless Liquid, Mild Alcoholic Smell

Flash Point: > 100°F

Flammable Limits in Air % by Volume: Lower Unknown Upper

Extinguisher Media: CO_2, Drychemical, Foam

Auto-Ignition Temperature: Unknown

Special Fire Fighting Procedures: Wear Self Conainted Breathing Apparatus

Unusual Fire and Explosion Hazards: Sealed Drums May Rupture Due To Internal Pressure. Toxic Vapors Will Be Evolved.

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SECTION 4 - PHYSICAL HAZARDS

Stability: Unstable [ ] / Stable [X] — Conditions to Avoid	Avoid hot serfaces, open flame, electrical arcs
Incompatability (Materials to Avoid)	Strong oxidizers,alkalies or acids
Hazardous Decomposition Products	Oxides of carbon, phosgene (small amounts), Hydrogen chloride
Hazardous Polymerization: May Occur [ ] / Will Not Occur [X] — Conditions to Avoid	None

SECTION 5 - HEALTH HAZARDS

Threshold Limit Value: AVG TLV=100 ppm

Signs and Symptoms of Exposure

1. Acute Overexposure: Depresses the central nervous system.
2. Chronic Overexposure: Have caused liver and kidney disease in experimental animals

Medical Conditions Generally Aggravated by Exposure: Acute and chronic liver and kidney disease, chronic lung disease, anemia,coronary disease or rhythm disorders of the heart.

Chemical Listed as Carcinogen or Potential Carcinogen: Methylene Chloride — National Toxicology Program: Yes [X] No [ ] — I.A.R.C. Monographs: Yes [ ] No [X] — OSHA: Yes [ ] No [X]

OSHA Permissible Exposure Limit: N/A — ACGIH Threshold Limit Value: N/A — Other Exposure Limit Used: Avg TLV=100 ppm

Emergency and First Aid Procedures

1. Inhalation: Remove to fresh air, administer oxygen if necessary
2. Eyes: Flush with water for 15 minutes. Call physician.
3. Skin: Remove contaminated clothing, flush with water for 15 minutes. Call a physician.
4. Ingestion: Do not induce vomiting. Call physician immediately.

SECTION 6 - SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type): Organic cartridge respirator above TLV

Ventilation: Normal Use — Local Exhaust: Generally unnecessary — Mechanical (General): Required — Special: Explosion proof — Other:

Protective Gloves: Viton, neoprene gloves — Eye Protection: Chemical safety goggles. No contact lenses.

Other Protective Clothing or Equipment: Apron,boots,headgear if splashing is a problem

SECTION 7 - SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

Precautions to be Taken in Handling and Storage: Avoid contact with skin, breathing of vapors. Pipe vent out doors, store in cool, dry, ventillated area. Vapors are heavier than air, will collect in low areas.

Other Precautions: Prevent moist air from entering storage. No smoking in presence of vapors. Contact with aluminum under pressurred fluid system may cause violent reaction.

Steps to be Taken in Case Material is Released or Spilled: Evaluate area, ventilate, contain spill. Clean area (wear protective gear) by mopping or using absorbent material. Place in sealed container.

Waste Disposal Methods: Use licensed reclaimer or waste management facility. Follow all local, state and federal regulations.

IMPORTANT
Do not leave any blank spaces. If required information is unavailable, unknown, or does not apply, so indicate.

AR300257

CHRONIC TOXICITY

...c overexposures to methylene chloride have caused liver and kidney disease in experimental ...ls.

...cinogenicity: Methylene chloride has been evaluated for possible cancer causing effects in laboratory ...imals. Inhalation studies at concentrations of 2,000, and 4,000 ppm increased the incidence of ...lignant liver and lung tumors in mice. Three inhalation studies of rats have shown increased incidence ... benign mammary gland tumors in female rats at concentrations of 500 ppm and above and increases in ...ign mammary gland tumors in males at concentrations of 1,500 ppm and above. Rats exposed to 50 and 2... ...pm via inhalation showed no increased incidence of tumors. Mice and rats exposed by ingestion at levels ...p to 250 mg/kg/day lifetime and hamsters exposed via inhalation to concentrations up to 3,500 ppm life... ...me did not show an increased incidence of tumors.

The International Agency for Cancer Research considers liver and lung tumors in mice as limited evidence ... animal carcinogenicity. The significance of benign mammary gland tumors is unknown.

Component A has caused increased incidence of nasal tumors in rats exposed by inhalation, forestomach tumors in rats exposed by gavage (forced-fed in oil) and injection site tumors when injected under the ...in of rats.

Epidemiology studies of 751 humans chronically exposed to methylene chloride in the workplace for a mini...m of 20 years did not demonstrate any increase in deaths caused by cancer or cardiac problems. A ...cond study of 2,227 workers confirmed these results.

Methylene chloride has been identified as animal carcinogen by NTP, but is not on the IARC or OSHA lists, ... of August 31, 1985. Component A has been identified as an animal carcinogen by IARC and NTP, but is ...t on the OSHA list.

...oductive Toxicity: Reproductive toxicity tests have been conducted to evaluate the potential adverse ...ts methylene chloride may have on reproduction and offspring of laboratory animals. The results in...dicate that methylene chloride does not cause birth defects, in laboratory animals.

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MATERIAL SAFETY DATA SHEE

R.W. Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS

Revised addition

MSDS NUMBER STS31-86 PAGE 1 OF

SECTION I NAME	24 HOUR EMERGENCY ASSISTANCE
PRODUCT Saf-T-Sol #31	CHEMTREC 800-424-9300
Blended By R.W. Eaken Inc. P.O. Box 171 Leesport, PA. 19533 (215) 926-2136	HAZARD RATING LEAST 0 SLIGHT 1 MODERATE 2 HIGH 3 EXTREME 4

HEALTH	2
FIRE	2
REACTIVITY	0

SECTION II INGREDIENTS

COMPOSITION	%	TOXICITY DATA	C.A.S. NUMBER
Aliphatic Hydrocarbon		100 ppm, ACGIH	64742-48-9
Aromatic Hydrocarbon		50 ppm, Exxon	64742-95-6

SECTION III HEALTH INFORMATION

ACUTE TOXICITY: Overexposure can lead to central nervous system depression producing such effects as headache, dizziness, nausea, and loss of consciousness.

EYE CONTACT: Short-term liquid or vapor contact may result in slight eye irritation. Prolonged and repeated contact may be more irritating.

SKIN CONTACT: Prolonged and repeated liquid contact can cause defatting and drying of the skin which may result in skin irritation or dermatitis.

INHALATION: High concentrations or prolonged exposure to lower concentrations may be slightly irritating to mucous membranes.

INGESTIONS: Liquid ingestion may result in vomiting; aspiration (breathing in) of liquid into the lungs MUST BE AVOIDED as liquid contact with the lungs can result in chemical pneumonitis and pulmonary edema/hemorrhage.

SECTION IV OCCUPATIONAL EXPOSURE LIMITS

000259

72 ppm, TLV/TWA; ACGIH

Material Safety Data Sheet

SECTION V EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: If splashed into eyes; flush with clear water for 15 minutes or until irritation subsides. If irritation persists, get medical attention.

SKIN CONTACT: Wash with soap and water. Remove contaminated clothing and do not reuse until laundered. If persistent irritation occurs, get medical attention.

INHALATION: Remove victim to fresh air and provide oxygen if breathing is difficult. Give artificial respiration if not breathing. Get medical attention.

INGESTION: DO NOT INDUCE VOMITING even though vomiting may occur. If vomiting occurs, keep head below hips to prevent aspiration of liquid into the lungs. Get medical attention.

NOTE TO PHYSICIAN: Depending upon the amount ingested and retained, as well as the toxicity of the product, gastric lavage should be considered. Keep patient's head below hips to prevent pulmonary aspiration. If comatose, a cuffed endotracheal tube will prevent aspiration. Consult a poison control center.

SECTION VI PHYSICAL DATA

BOILING POINT (°F)	311	MELTING POINT (°F)	< 0°F	VAPOR PRESSURE (mmHg)	8.25
SPECIFIC GRAVITY (H_2O=1)	.793 @ 60°F	% VOLATILE BY VOLUME	100	VAPOR DENSITY (AIR = 1)	3.53
SOLUBILITY IN WATER	Negligible	EVAPORATION RATE (BUTYL ACETATE = 1)	0.165	AUTO IGNITION TEMPERATURE	500°F

APPEARANCE AND ODOR
Water white liquid, aromatic hydrocarbon odor

SECTION VII FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD USED	FLAMMABLE LIMITS/% VOLUME IN AIR	LOWER	UPPER
104°F, T.C.C.	estimated	1.0	7.0

EXTINGUISHING MEDIA

Use water spray or fog, foam, dry chemical or carbon dioxide. Do not use a direct water stream. Avoid accumulation of water as product will float.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS

Do not enter confined fire space without proper protective equipment including a NIOSH approved self-contained breathing apparatus. Cool fire-exposed containers, surrounding equipment and structures with water.

UNUSUAL FIRE AND EXPLOSION HAZARDS

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Material Safety Data Sheet

R.W. Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS

SECTION VIII REACTIVITY

STABILITY	☐ UNSTABLE	☒ STABLE	HAZARDOUS POLYMERIZATION	☐ MAY OCCUR	☒ WILL NOT OCCUR

CONDITIONS AND MATERIALS TO AVOID

Keep liquid and vapor away from heat, sparks and flame.
Do not mix or store with acids, bases, or other oxidizing materials.
Prevent vapor accumulation.

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon Dioxide, Carbon Monoxide and other unidentified organic compounds may be formed during combustion.

SECTION IX EMPLOYEE PROTECTION

RESPIRATORY PROTECTION
Use NIOSH approved organic vapor respirator within the limitation of this device, to prevent overexposure. Use positive pressure self contained breathing apparatus in other situations.

PROTECTIVE CLOTHING
Wear impervious gloves (Neoprene, Viton) and protective clothing as required to prevent skin contact. Wear chemical goggles, safety glasses, or face shield to protect eyes.

ADDITIONAL PROTECTIVE MEASURES
In operations where spilling and splashing occurs, use impervious apron and boots to protect body. Eyewash stations and showers should be readily available. Spark resistant tools are recommended. Wash hands thoroughly with soap and water after handling.

SECTION X ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES
WARNING: COMBUSTIBLE! Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking.

LARGE SPILLS: Evacuate the hazard area of unprotected personnel. Wear appropriate protective equipment. Shut off source of leak only if safe to do so. Dike and contain liquid. If vapor cloud forms, water fog may be used to suppress; contain run-off. Remove liquid with vacuum truck/pumps to storage/salvage containers. Soak up residue with absorbent materials; place in non-leaking containers to await proper disposal. Flush area to remove trace; collect flushings, dispose of properly.

SMALL SPILLS: Take up with an absorbent material and place in non leaking container; seal tightly and dispose of properly.

WASTE DISPOSAL
Dispose of through RCRA approved TS&D facility. Use non-leaking 17E or tightly sealed 17H drums. Label properly. Check state and local laws.
Methods of Disposal: Incineration, Recycling, Solidification and Landfill.

ENVIRONMENTAL HAZARDS
This product is a hazardous material and should not be allowed to enter surface waters, sewer systems, and drainage areas. Releases to environment may be reportable under environmental regulations.

R.W.Esken Inc. SOLVENT AND LUBRICANT SPECIALISTS

Material Safety Data Sheet

SECTION XI SPECIAL PRECAUTIONS

WARNING! COMBUSTIBLE!

Keep liquid and vapor away from heat, sparks and flame.
Use spark resistant tools.
Ground all equipment. Bond and ground transfer equipment.
Do not weld, drill or grind on containers!
Empty containers may contain explosive or combustible vapors.
Keep containers tightly closed when not in use.
Store containers properly.
Surfaces that are sufficiently hot may ignite liquid material even in absence of spark or flame.

SECTION XII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION

☐ FLAMMABLE LIQUID	☐ COMBUSTIBLE LIQUID	☐ OXIDIZING MATERIAL	☐ NON-FLAMMABLE GAS
☐ FLAMMABLE SOLID	☐ POISON, CLASS A	☐ CORROSIVE MATERIAL	☐ NOT HAZARDOUS BY D.O.T. REGULATIONS
☐ FLAMMABLE GAS	☐ POISON, CLASS B	☐ IRRITATING MATERIAL	☐ OTHER Specify below

D.O.T. PROPER SHIPPING NAME
Compound, Cleaning, Liquid Combustible Liquid NA 1993

OTHER REQUIREMENTS Waste Classification:
WASTE COMPOUND, CLEANING, LIQUID Combustible Liquid NA 1993
or WASTE COMBUSTIBLE LIQUID N.O.S. Combustible Liquid NA 1993

SECTION XIII OTHER REGULATORY CONTROLS

EPA, FDA, OSHA, USDA, CPSC, ETC.

EPA - Resource Conservation Recovery Act (RCRA)

If this product can no longer be used, or is part of a waste stream - the resultant would be classified as hazardous waste.

HAZARDOUS WASTE CODE NUMBER - D001

EPA - Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

Releases to air, land, and/or water are reportable under CERCLA (Superfund) when release exceeds reportable quantity.

RQ - None

EMERGENCY RESPONSE GUIDE - #27

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof.
Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

M.J. Frankhouser Tech. Asst.
SIGNATURE/TITLE

R.W. Esken Inc.
P.O. Box 171 Leesport, PA. 19533
(215) 926-2136

DATE PREPARED: November 1986

MATERIAL SAFETY DATA SHEET

R.W. Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS
SINCE 1932

MSDS NUMBER STS15-85

SECTION I NAME

PRODUCT SAF-T-SOL #15

Blended By R.W. Eaken Inc.
P.O. Box 171 Leesport, PA. 19533
(215) 926-2136

24 HOUR EMERGENCY ASSISTANCE

CHEMTREC 800-424-9300

HAZARD RATING

LEAST	SLIGHT	MODERATE	HIGH	EXTREME
0	1	2	3	4

HEALTH	2
FIRE	1
REACTIVITY	0

SECTION II INGREDIENTS

COMPOSITION	%	TOXICITY DATA	C.A.S. NUMBER
1,1,1 - Trichloroethane		350ppm, ACGIH	71-55-6
Aliphatic hydrocarbon		100ppm, ACGIH	64742-48-9

SECTION III HEALTH INFORMATION

ACUTE TOXICITY: Overexposure can lead to central nervous system depression producing such effects as headaches, dizziness, nausea and unconsciousness.

EYE CONTACT: Vapors and liquids may cause irritation. Has possibility of causing slight transient corneal injury through contact.

SKIN CONTACT: Prolonged or repeated exposure may cause skin irritation repeated contact may cause defatting of skin.

INHALATION: Low level vapor concentrations may cause anesthetic or narcotic effects. High concentration and/or long term exposure may irritate respiratory system; dizziness; drunkenness, and extreme cases, unconsciousness.

INGESTION: Liquid ingestion may be marked by nausea, vomiting, dizziness, stomach irritation and possible unconsciousness.

SYSTEMIC: May cause increase in carboxyhemoglobin level. May increase myocardial irritability.

SECTION IV OCCUPATIONAL EXPOSURE LIMITS

181 ppm TLV/TWA; ACGIH

Material Safety Data Sheet

SECTION V EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Irrigate with flowing water for at least 15 minutes. If irritation persists, get medical attention.

SKIN CONTACT: Wash off in flowing water or shower. Remove contaminated clothing and shoes. Do not reuse clothing or shoes until cleaned. If irritation persists, seek medical attention. If rash persists, treat as contact dermatitis.

INHALATION: If breathing difficulties, dizziness, or light headedness occur, get victim to fresh air. If breathing stops, administer artificial respiration - preferably mouth to mouth. (Note: Vapors tend to accumulate in low areas, areas of inadequate ventilation,corners and pits.)

SYSTEMIC: Avoid Epinephrine or similar acting drugs if at all possible. Consult standard literature.

INGESTION: DO NOT INDUCE VOMITING, but if vomiting occurs spontaneously, keep head below the hips to prevent aspiration of liquid into the lungs.
DO NOT GIVE LIQUIDS. Contact Physician immediately.

Physician's Note: May cause chemical pneumonia if aspirated into lungs. Danger of chemical pneumonia must be weighed against toxicity when considering emptying the stomach. If lavage is performed, suggest endotracheal and/or esophagoscopic control.

SECTION VI PHYSICAL DATA

BOILING POINT (°F)	165	MELTING POINT (°F)	est. -34	VAPOR PRESSURE (mmHg)	53.75
SPECIFIC GRAVITY (H_2O=1)	1.04 @ 60°F	% VOLATILE BY VOLUME	100	VAPOR DENSITY (AIR = 1)	4.625
SOLUBILITY IN WATER	negligible	EVAPORATION RATE (BUTYL ACETATE = 1)	3.075	AUTO IGNITION TEMPERATURE	est. 500°F

APPEARANCE AND ODOR

water white liquid, chlorinated hydrocarbon odor

SECTION VII FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD USED	FLAMMABLE LIMITS/% VOLUME IN AIR	LOWER	UPPER
no flash to boiling point, T.C.C.	estimated	1.0	7.0

EXTINGUISHING MEDIA

Water fog, "Alcohol" foam, Dry Chemical, Carbon Dioxide.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS

Use NIOSH approved positive pressure self contained breathing apparatus in confined areas. Use water to cool exposed containers. Fire should be contained if possible, wear protective coating.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Vapor is heavier than air and may travel great distance. Vapors have tendencies to hang in enclosed areas of less than adequate ventilation.

300264

Material Safety Data Sheet

R.W. Eaken Inc. SOLVENT AND LUBRICANT SPECIALISTS

SECTION VIII REACTIVITY

STABILITY ☐ UNSTABLE ☒ STABLE | HAZARDOUS POLYMERIZATION ☐ MAY OCCUR ☒ WILL NOT OCCUR

CONDITIONS AND MATERIALS TO AVOID

Gas and oil heaters, open flames and arc welding are capable of causing thermal decomposition. Do not mix or store with strong acids, bases or oxidizers. Do not store in aluminum, zinc, or magnesium containers. Hydrolysis producing small amounts of hydrochloric acid possible with gross water contamination.

HAZARDOUS DECOMPOSITION PRODUCTS

Thermal degredation produces hydrogen chloride, carbon monoxide, and very small amounts of phosgene and chlorine.

SECTION IX EMPLOYEE PROTECTION

RESPIRATORY PROTECTION

Use NIOSH approved organic vapor respirator within the limitation of this device. To prevent overexposure, use positive pressure self contained breathing apparatus in all other situations.

PROTECTIVE CLOTHING

Wear impervious gloves (Neoprene, Viton) and protective clothing as required to prevent skin contact. Wear chemical goggles, safety glasses, or faceshield to protect eyes.

ADDITIONAL PROTECTIVE MEASURES

In operations where spilling and splashing occurs, use impervious apron and boots to protect the body. Eye wash stations and showers must be readily available. Spark resistant tools suggested. Wash hands with soap and water after handling.

SECTION X ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES

Ground and/or bond all equipment.

LARGE SPILLS: Evacuate hazard area of unprotected personnel. Wear appropriate protective equipment. Shut off source of leak only when safe to do so. Dike and contain liquid. Remove liquid with vacuum truck or pump to non leaking salvage or storage containers. Soak up residue with absorbent materials; place into non leaking drums to await proper disposal. Flush area to remove trace amounts, collect flushings, dispose of properly.

SMALL SPILLS: Take up with an absorbent material and place in a non leaking container; seal tightly and dispose of properly.

WASTE DISPOSAL

Dispose of through RCRA approved TS&D facility, with respect to all state and local laws.
Methods of Disposal: Recycling, Incineration or as last resort - Landfilling.

ENVIRONMENTAL HAZARDS

This product is to be considered a hazardous material and should not be allowed to enter surface waters or sewerage systems. Releases into environment may be reportable under state and/or federal regulations.

R.W. Eaken Inc. SOLVENT AND LUBRICANT SPECIALISTS

Material Safety Data Sheet

SECTION XI SPECIAL PRECAUTIONS

Keep liquid or vapors away from open flames or sparks.
Ground all equipment.
Do not weld, drill or grind on containers!
Empty containers are still considered hazardous.
Keep containers tightly closed. Store properly out of weather when possible.
Hot surfaces may cause thermal decomposition and thusly, resultant noxious gases. Always have adequate ventilation in work and laboratory areas.

SECTION XII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION

☐ FLAMMABLE LIQUID	☐ COMBUSTIBLE LIQUID	☐ OXIDIZING MATERIAL	☐ NON-FLAMMABLE GAS
☐ FLAMMABLE SOLID	☐ POISON, CLASS A	☐ CORROSIVE MATERIAL	☒ NOT HAZARDOUS BY D.O.T. REGULATIONS
☐ FLAMMABLE GAS	☐ POISON, CLASS B	☐ IRRITATING MATERIAL	☐ OTHER Specify below

D.O.T. PROPER SHIPPING NAME SAF-T-SOL #15 Not Considered Hazardous Material In Virgin State

OTHER REQUIREMENTS Waste Name:

or Waste Solvent N.O.S. CRM-A NA1993
Waste 1,1,1 - Trichloroethane CRM-A UN2831

SECTION XIII OTHER REGULATORY CONTROLS

EPA, FDA, OSHA, USDA, CPSC, ETC.

EPA - Resource Conservation Recovery Act (RCRA)

If this product can no longer be used, or is part of a waste stream, the resultant would be classified as a hazardous waste.

HAZARDOUS WASTE CODE NUMBER - F001, D001

EPA - Comprehensive Environmental Response, Compensation, Liability Act (CERCLA)

Releases to air, land or water are reportable under CERCLA (Superfund) when releases exceed reportable quantities.

RQ - None

EMERGENCY RESPONSE GUIDE - #74, #27

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

Tech. Asst.

SIGNATURE/TITLE

R.W. Eaken Inc.
P.O. Box 171 Leesport, PA. 19533
(215) 926-2136

DATE PREPARED OCT

MATERIAL SAFETY DATA SHEET

R.W.Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS
SINCE 1937

MSDS NUMBER STS12-85

SECTION I NAME

PRODUCT SAF-T-SOL #12

Blended By R.W. Eaken Inc.
P.O. Box 171 Leesport, PA. 19533
(215) 926-2136

24 HOUR EMERGENCY ASSISTANCE

CHEMTREC 800-424-9300

HAZARD RATING

LEAST	SLIGHT	MODERATE	HIGH	EXTREME
0	1	2	3	4

HEALTH	2
FIRE	1
REACTIVITY	0

SECTION II INGREDIENTS

COMPOSITION	%	TOXICITY DATA	C.A.S. NUMBER
Methylene chloride		100ppm, ACGIH	75-09-2
Methanol		200ppm, ACGIH	67-56-1
Toluene		100ppm, ACGIH	108-88-3

SECTION III HEALTH INFORMATION

ACUTE TOXICITY: Overexposure can lead to central nervous system depression producing such effects as headaches, dizziness, nausea and unconsciousness.

EYE CONTACT: Vapors and liquids may cause irritation. Has possibility of causing slight transient corneal injury through contact.

SKIN CONTACT: Prolonged or repeated exposure may cause skin irritation repeated contact may cause defatting of skin.

INHALATION: Low level vapor concentrations may cause anesthetic or narcotic effects. High concentration and/or long term exposure may irritate respiratory system; dizziness; drunkenness, and extreme cases, unconsciousness.

INGESTION: Liquid ingestion may be marked by nausea, vomiting, dizziness, stomach irritation and possible unconsciousness. Cannot be made non-poisonous, may cause blindness or death.

SYSTEMIC: May cause increase in carboxyhemoglobin level. May increase myocardial irritability.

SECTION IV OCCUPATIONAL EXPOSURE LIMITS

113 ppm TLV/TWA; ACGIH

~~000267~~

Material Safety Data Sheet

SECTION V EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Irrigate with flowing water for at least 15 minutes. If irritation persists, get medical attention.

SKIN CONTACT: Wash off in flowing water or shower. Remove contaminated clothing and shoes. Do not reuse clothing or shoes until cleaned. If irritation persists, seek medical attention. If rash persists, treat as contact dermatitis.

INHALATION: If breathing difficulties, dizziness, or light headedness occur, get victim to fresh air. If breathing stops, administer artificial respiration - preferably mouth to mouth. (Note: Vapors tend to accumulate in low areas, areas of inadequate ventilation,corners and pits.)

SYSTEMIC: Avoid Epinephrine or similar acting drugs if at all possible. Consult standard literature.

INGESTION: DO NOT INDUCE VOMITING, but if vomiting occurs spontaneously, keep head below the hips to prevent aspiration of liquid into the lungs.
DO NOT GIVE LIQUIDS. Contact Physician immediately.
Signs and symptoms of the poisoning may not be immediate after ingestion.

Physician's Note: May cause chemical pneumonia if aspirated into lungs. Danger of chemical pneumonia must be weighed against toxicity when considering emptying the stomach. If lavage is performed, suggest endotracheal and/or esophagoscopic control.

SECTION VI PHYSICAL DATA

BOILING POINT (°F) 104	MELTING POINT (°F) est. -137	VAPOR PRESSURE (mmHg) 240.6
SPECIFIC GRAVITY (H_2O=1) 1.15 @ 60°F	% VOLATILE BY VOLUME 100	VAPOR DENSITY (AIR = 1) 2.71
SOLUBILITY IN WATER moderate	EVAPORATION RATE (BUTYL ACETATE = 1) 10.13	AUTO IGNITION TEMPERATURE est. 725°F

APPEARANCE AND ODOR
water white liquid, chlorinated hydrocarbon odor

SECTION VII FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD USED	FLAMMABLE LIMITS/% VOLUME IN AIR	LOWER	UPPER
no flash to boiling point, T.C.C.	estimated	1.2	7.1

EXTINGUISHING MEDIA
Water fog, "Alcohol" foam, Dry Chemical, Carbon Dioxide.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS
Use NIOSH approved positive pressure self contained breathing apparatus in confined areas. Use water to cool exposed containers. Fire should be contained if possible, wear protective coating.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Vapor is heavier than air and may travel great distance. Vapors have tendencies to hang in enclosed areas of less than adequate ventilation.

300268

Material Safety Data Sheet

R.W. Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS

SECTION VIII REACTIVITY

STABILITY	☐ UNSTABLE	☒ STABLE	HAZARDOUS POLYMERIZATION	☐ MAY OCCUR	☒ WILL NOT OCCUR

CONDITIONS AND MATERIALS TO AVOID

Gas and oil heaters, open flames and arc welding are capable of causing thermal decomposition. Do not mix or store with strong acids, bases or oxidizers. Do not store in aluminum, zinc, or magnesium containers. Hydrolysis producing small amounts of hydrochloric acid possible with gross water contamination.

HAZARDOUS DECOMPOSITION PRODUCTS

Thermal degredation produces hydrogen chloride, carbon monoxide, and very small amounts of phosgene and chlorine.

SECTION IX EMPLOYEE PROTECTION

RESPIRATORY PROTECTION

Use NIOSH approved organic vapor respirator within the limitation of this device. To prevent overexposure, use positive pressure self contained breathing apparatus in all other situations.

PROTECTIVE CLOTHING

Wear impervious gloves (Neoprene, Viton) and protective clothing as required to prevent skin contact. Wear chemical goggles, safety glasses, or faceshield to protect eyes.

ADDITIONAL PROTECTIVE MEASURES

In operations where spilling and splashing occurs, use impervious apron and boots to protect the body. Eye wash stations and showers must be readily available. Spark resistant tools suggested. Wash hands with soap and water after handling.

SECTION X ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES

Ground and/or bond all equipment.

LARGE SPILLS: Evacuate hazard area of unprotected personnel. Wear appropriate protective equipment. Shut off source of leak only when safe to do so. Dike and contain liquid. Remove liquid with vacuum truck or pump to non leaking salvage or storage containers. Soak up residue with absorbent materials; place into non leaking drums to await proper disposal. Flush area to remove trace amounts, collect flushings, dispose of properly.

SMALL SPILLS: Take up with an absorbent material and place in a non leaking container; seal tightly and dispose of properly.

WASTE DISPOSAL

Dispose of through RCRA approved TS&D facility, with respect to all state and local laws.
Methods of Disposal: Recycling, Incineration or as last resort - Landfilling.

ENVIRONMENTAL HAZARDS

This product is to be considered a hazardous material and should not be allowed to enter surface waters or sewerage systems. Releases into environment may be reportable under state and/or federal regulations.

Material Safety Data Sheet

SECTION XI SPECIAL PRECAUTIONS

Keep liquid or vapors away from open flames or sparks.
Ground all equipment.
Do not weld, drill or grind on containers!
Empty containers are still considered hazardous.
Keep containers tightly closed. Store properly out of weather when possible.
Hot surfaces may cause thermal decomposition and thusly,resultant noxious gases. Always have adequate ventilation in work and laboratory areas.

SECTION XII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION				
	☐ FLAMMABLE LIQUID	☐ COMBUSTIBLE LIQUID	☐ OXIDIZING MATERIAL	☐ NON-FLAMMABLE GAS
	☐ FLAMMABLE SOLID	☐ POISON, CLASS A	☐ CORROSIVE MATERIAL	☒ NOT HAZARDOUS BY D.O.T. REGULATIONS
	☐ FLAMMABLE GAS	☐ POISON, CLASS B	☐ IRRITATING MATERIAL	☐ OTHER Specify below

D.O.T. PROPER SHIPPING NAME SAF-T-SOL #12 Not Considered Hazardous Material In Virgin State

OTHER REQUIREMENTS

Waste Name: Waste Solvent N.O.S. ORM-A NA1993

SECTION XIII OTHER REGULATORY CONTROLS

EPA, FDA, OSHA, USDA, CPSC, ETC.

EPA - Resource Conservation Recovery Act (RCRA)

If this product can no longer be used, or is part of a waste stream, the resultant would be classified as a hazardous waste.

HAZARDOUS WASTE CODE NUMBER - F001, F005, D001

EPA - Comprehensive Environmental Response, Compensation, Liability Act (CERCLA)

Releases to air, land or water are reportable under CERCLA (Superfund) when releases exceed reportable quantities.

RQ - 1000 Pounds/Container

EMERGENCY RESPONSE GUIDE - #26, #27, #74

M. J. Frankhouser Tech. Asst.
SIGNATURE/TITLE

R.W. Eaken Inc.
P.O. Box 171 Leesport, PA. 19533
(215) 926-2136

DATE PREPARED OCT [illegible]

MATERIAL SAFETY DATA SHEET

R.W. Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS

MSDS NUMBER STS5-85

SECTION I NAME

PRODUCT SAF-T-SOL #5

Blended By R.W. Eaken Inc.
P.O. Box 171 Leesport, PA. 19533
(215) 926-2136

24 HOUR EMERGENCY ASSISTANCE

CHEMTREC 800-424-9300

HAZARD RATING
LEAST 0, SLIGHT 1, MODERATE 2, HIGH 3, EXTREME 4

HEALTH	2
FIRE	1
REACTIVITY	0

SECTION II INGREDIENTS

COMPOSITION	%	TOXICITY DATA	C.A.S. NUMBER
Methylene chloride		100ppm, ACGIH	75-09-2
Perchloroethylene		50ppm, ACGIH	127-18-4
Aliphatic hydrocarbon		100ppm, ACGIH	64742-48-9

SECTION III HEALTH INFORMATION

ACUTE TOXICITY: Overexposure can lead to central nervous system depression producing such effects as headaches, dizziness, nausea and unconsciousness.

EYE CONTACT: Vapors and liquids may cause irritation. Has possibility of causing slight transient corneal injury through contact.

SKIN CONTACT: Prolonged or repeated exposure may cause skin irritation repeated contact may cause defatting of skin.

INHALATION: Low level vapor concentrations may cause anesthetic or narcotic effects. High concentration and/or long term exposure may irritate respiratory system, dizziness, drunkenness, and extreme cases, unconsciousness.

INGESTION: Liquid ingestion may be marked by nausea, vomiting, dizziness, stomach irritation and possible unconsciousness.

SYSTEMIC: May cause increase in carboxyhemoglobin level. May increase myocardial irritability.

SECTION IV OCCUPATIONAL EXPOSURE LIMITS

78 ppm TLV/TWA; ACGIH

300271

AR300271

Material Safety Data Sheet

SECTION V EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Irrigate with flowing water for at least 15 minutes. If irritation persists, get medical attention.

SKIN CONTACT: Wash off in flowing water or shower. Remove contaminated clothing and shoes. Do not reuse clothing or shoes until cleaned. If irritation persists, seek medical attention. If rash persists, treat as contact dermatitis.

INHALATION: If breathing difficulties, dizziness, or light headedness occur, get victim to fresh air. If breathing stops, administer artificial respiration - preferably mouth to mouth. (Note: Vapors tend to accumulate in low areas, areas of inadequate ventilation,corners and pits.)

SYSTEMIC: Avoid Epinephrine or similar acting drugs if at all possible. Consult standard literature.

INGESTION: DO NOT INDUCE VOMITING, but if vomiting occurs spontaneously, keep head below the hips to prevent aspiration of liquid into the lungs.
DO NOT GIVE LIQUIDS. Contact Physician immediately.

Physician's Note: May cause chemical pneumonia if aspirated into lungs. Danger of chemical pneumonia must be weighed against toxicity when considering emptying the stomach. If lavage is performed, suggest endotracheal and/or esophagoscopic control.

SECTION VI PHYSICAL DATA

BOILING POINT (°F) 103	MELTING POINT (°F) est. -9	VAPOR PRESSURE (mmHg) 41.96
SPECIFIC GRAVITY (H_2O=1) 1.005 @ 60°F	% VOLATILE BY VOLUME 100	VAPOR DENSITY (AIR = 1) 4.76
SOLUBILITY IN WATER negligible	EVAPORATION RATE (BUTYL ACETATE = 1) 2.01	AUTO IGNITION TEMPERATURE est. 500°F

APPEARANCE AND ODOR
water white liquid, chlorinated hydrocarbon odor

SECTION VII FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD USED	FLAMMABLE LIMITS/% VOLUME IN AIR	LOWER	UPPER
no flash to boiling point, T.C.C.	estimated	14.8	22

EXTINGUISHING MEDIA
Water fog, "Alcohol" foam, Dry Chemical, Carbon Dioxide.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS
Use NIOSH approved positive pressure self contained breathing apparatus in confined areas. Use water to cool exposed containers. Fire should be contained if possible, wear protective coating.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Vapor is heavier than air and may travel great distance. Vapors have tendencies to hang in enclosed areas of less than adequate ventilation.

Material Safety Data Sheet

R.W. Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS

MSDS NUMBER STS5-85 PAGE 3 of

SECTION VIII REACTIVITY

STABILITY	UNSTABLE	XX STABLE	HAZARDOUS POLYMERIZATION	MAY OCCUR	XX WILL NOT OCCUR

CONDITIONS AND MATERIALS TO AVOID

Gas and oil heaters, open flames and arc welding are capable of causing thermal decomposition. Do not mix or store with strong acids, bases or oxidizers. Do not store in aluminum, zinc, or magnesium containers. Hydrolysis producing small amounts of hydrochloric acid possible with gross water contamination.

HAZARDOUS DECOMPOSITION PRODUCTS

Thermal degredation produces hydrogen chloride, carbon monoxide, and very small amounts of phosgene and chlorine.

SECTION IX EMPLOYEE PROTECTION

RESPIRATORY PROTECTION

Use NIOSH approved organic vapor respirator within the limitation of this device. To prevent overexposure, use positive pressure self contained breathing apparatus in all other situations.

PROTECTIVE CLOTHING

Wear impervious gloves (Neoprene, Viton) and protective clothing as required to prevent skin contact. Wear chemical goggles, safety glasses, or faceshield to protect eyes.

ADDITIONAL PROTECTIVE MEASURES

In operations where spilling and splashing occurs, use impervious apron and boots to protect the body. Eye wash stations and showers must be readily available. Spark resistant tools suggested. Wash hands with soap and water after handling.

SECTION X ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES

Ground and/or bond all equipment.

LARGE SPILLS: Evacuate hazard area of unprotected personnel. Wear appropriate protective equipment. Shut off source of leak only when safe to do so. Dike and contain liquid. Remove liquid with vacuum truck or pump to non leaking salvage or storage containers. Soak up residue with absorbent materials; place into non leaking drums to await proper disposal. Flush area to remove trace amounts, collect flushings, dispose of properly.

SMALL SPILLS: Take up with an absorbent material and place in a non leaking container; seal tightly and dispose of properly.

WASTE DISPOSAL

Dispose of through RCRA approved TS&D facility, with respect to all state and local laws.
Methods of Disposal: Recycling, Incineration or as last resort - Landfilling.

ENVIRONMENTAL HAZARDS

This product is to be considered a hazardous material and should not be allowed to enter surface waters or sewerage systems. Releases into environment may be reportable under state and/or federal regulations.

AR300273

R.W. Eaken Inc.
SOLVENT AND LUBRICANT SPECIALISTS

Material Safety Data Sheet

SECTION XI SPECIAL PRECAUTIONS

Keep liquid or vapors away from open flames or sparks.
Ground all equipment.
Do not weld, drill or grind on containers!
Empty containers are still considered hazardous.
Keep containers tightly closed. Store properly out of weather when possible.
Hot surfaces may cause thermal decomposition and thusly,resultant noxious gases. Always have adequate ventilation in work and laboratory areas.

SECTION XII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION

☐ FLAMMABLE LIQUID	☐ COMBUSTIBLE LIQUID	☐ OXIDIZING MATERIAL	☐ NON-FLAMMABLE GAS
☐ FLAMMABLE SOLID	☐ POISON, CLASS A	☐ CORROSIVE MATERIAL	☒ NOT HAZARDOUS BY D.O.T. REGULATIONS
☐ FLAMMABLE GAS	☐ POISON, CLASS B	☐ IRRITATING MATERIAL	☐ OTHER Specify below

D.O.T. PROPER SHIPPING NAME SAF-T-SOL #5 Not Hazardous Material In Virgin State

OTHER REQUIREMENTS

Waste Name: Waste Solvent N.O.S. ORM-A NA1993

SECTION XIII OTHER REGULATORY CONTROLS

EPA, FDA, OSHA, USDA, CPSC, ETC.

EPA - Resource Conservation Recovery Act (RCRA)

If this product can no longer be used, or is part of a waste stream, the resultant would be classified as a hazardous waste.

HAZARDOUS WASTE CODE NUMBER - F001, D001

EPA - Comprehensive Environmental Response, Compensation, Liability Act (CERCLA)

Releases to air, land or water are reportable under CERCLA (Superfund) when releases exceed reportable quantities.

RQ - None

EMERGENCY RESPONSE GUIDE - #74, #27

M. J. Frankhouser Tech. Asst.
SIGNATURE/TITLE

R.W. Eaken Inc.
P.O. Box 171 Leesport, PA. 19533
(215) 926-2136

DATE PREPARED OCT 1985

APPENDIX B

RESUMES OF KEY PERSONNEL

CHARLES H. AU
PRESIDENT

EDUCATION

B.S., 1953, Civil Engineering, Case Institute of Technology

REGISTRATION

Professional Engineer: Ohio, Pennsylvania

PROFESSIONAL EXPERIENCE

1985 to Present: Mr. Au is the President of Remcor, Inc., bringing together the engineering and field services capabilities to provide engineered solutions to waste management issues. Mr. Au serves a technical role in the evaluation of constructibility and cost of remedial alternatives involving earthwork, pipeline construction/rehabilitation, and facility demolition.

1984: Mr. Au served as the Chief Operating Officer for Garvey Industries, Inc. in Wichita, Kansas, responsible for the profitable operation of 40 individual companies involved in diverse industries throughout the United States.

1953 to 1983: Most of Mr. Au's career has centered around the organization and management of Roger J. Au & Son, Inc. (Au), a heavy, diversified civil and marine construction company with corporate headquarters in Mansfield, Ohio.

The firm, founded in 1936, was a small local construction company. In 1957, he began managing the firm and built it into a sophisticated, well-run, financially sound organization that was one of the most respected and largest firms of its kind in the Midwest. Contract totals at their peak exceeded $160 million.

Mr. Au also established and served as President or Chairman of several companies affiliated with the construction firm. He had primary responsibility for the organizational management and all legal and financial matters of the following companies:

- Rauco Insurance Company, Ltd., Bermuda - Captive offshore liability carrier

- Rice-Young-Cooper-Mitchell Insurance Agency, Mansfield, Ohio

- Cleveland Tractor Company, Cleveland, Ohio - Heavy equipment dealer

- Mansfield Equipment Company, Mansfield, Ohio - Heavy equipment dealer

- Cdeco Maritime Construction Company - Heavy civil and maritime equipment holding company with $65 million worth of equipment

- Cee-Em Realty Company - Management of industrial properties

- Au-Rel - Design and construct engineering projects.

OTHER TRAINING

Successful completion of the "Hazardous Materials Handling" Course, May 1986, NUS Corporation, Pittsburgh, Pennsylvania.

LEO M. BRAUSCH
VICE PRESIDENT

EDUCATION

M.S., 1976, Civil and Environmental Engineering, University of Cincinnati

B.S.C.E., 1975, Civil and Environmental Engineering, University of Cincinnati

REGISTRATION

Professional Engineer: Mississippi, New Mexico, Ohio, Pennsylvania

Emergency Medical Technician: Pennsylvania

PROFESSIONAL EXPERIENCE

1985 to Present: Mr. Brausch is Vice President of Remcor, Inc. in responsible charge of the Engineering and Project Development Division. In this role, he has served as the director and key technical contributor for approximately 50 site investigation and site cleanup projects. Examples of key experiences follows:

- Investigation and subsequent cleanup of a 90-acre industrial complex in western Pennsylvania. This project involved the assessment of contamination and design and implementation of remedial measures associated with: polychlorinated biphenyl (PCB) decontamination of plant buildings, equipment, and process sewers; closure of a former PCB waste disposal area; decontamination and closure of electroplating facilities; and plant-wide removal of asbestos-containing materials.

- Subsurface investigations and design of cleanup programs associated with petroleum hydrocarbon (PHC) contamination at two sites in New Jersey. Work involved assessing contamination from leaking underground storage tanks, spills, and other sources. Remedial measures evaluated include free product recovery, ground water treatment, tank removal, tank closure, bioreclamation, and slurry wall containment.

- Remedial investigation/feasibility study (RI/FS) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of a six-acre landfill containing an estimated 100,000 cubic yards of PCB-contaminated materials. After extensive site studies, three technically feasible, cost-effective remedial alternatives were developed.

- The Resource Conservation and Recovery Act (RCRA) closure plan development and implementation for five surface impoundments containing 8,000 cubic yards of electroplating sludge at a site in Mississippi. The closure involves on-site dewatering of the sludge, in-situ containment of contaminated soils, and ground water recovery/treatment. In addition, potential continuing releases from other on-site solid waste management units (SWMUs) are being investigated.

- Subsurface investigations of volatile organic contamination associated with former drummed and bulk solvent disposal areas and underground solvent storage tanks at two industrial plant sites. The investigations included borings, soil and ground water testing, and use of an organic vapor analyzer to determine the presence of subsurface volatile organic contamination.

Mr. Brausch has also served as an expert witness. For a major civil action involving PCB contamination of five industrial facilities in three states, Mr. Brausch testified relative to contamination assessment methods, decontamination procedures and costs, and PCB transport mechanisms and pathways in interior settings. In adjudicatory hearings for a proposed hazardous waste landfill in Ohio, Mr. Brausch addressed design, construction, operational, and closure issues.

1980 to 1985: Mr. Brausch served as the Manager of Project Development for IT Corporation in Pittsburgh, Pennsylvania (formerly D'Appolonia Waste Management Services). His primary role was in the planning and development of remedial response programs for formerly utilized waste disposal sites. Representative experiences included the following:

- Project manager for the investigation of the degree and extent of PCB contamination at seven facility locations in five states. These projects included development and execution of investigation programs, evaluation of alternative decontamination technologies, and preparation of detailed decontamination plans and cost estimates.

- Project manager for the preparation of a RCRA closure plan for a formerly used secondary lead smelter site in Florida. The project involved a comprehensive contamination survey, subsurface exploration, and ground water monitoring. Mr. Brausch headed the design team for waste removal, facility decontamination, and ground water treatment aspects of the closure.

- Project director for the preparation of the RCRA closure plan for two lagoons (containing nearly 100,000 cubic yards of mixed organic and inorganic sludges) at a plant site in southern Ohio. The closure plan calls for dewatering and physical stabilization of sludges preparatory to on-site containment.

In addition to such assignments, Mr. Brausch served as an in-house consultant in health and safety programs; air quality monitoring during waste site cleanup; and waste analysis, manifesting, transportation, and disposal.

1978 to 1980: Mr. Brausch served as the Lead Engineer, Environmental Issues, for the environmental and safety analysis of the Waste Isolation Pilot Plant (WIPP) proposed for a site east of Carlsbad, New Mexico. This position involved coordinating and leading investigations attendant to all environmental permits, approvals, and compliances required for this radioactive waste storage/disposal facility.

1976 to 1978: Mr. Brausch served as a project leader and technical contributor on interdisciplinary environmental investigations and engineering designs. His principal involvement was in environmental permitting and the design of pollution control facilities. Representative technical tasks and responsibilities included air quality and meteorological monitoring, preparation of emission inventories, and evaluations of control technologies for new-source air quality permitting. Mr. Brausch also prepared the process, hydraulic, and structural design of industrial wastewater treatment facilities. Key issues in the treatment schemes included the design and economic analysis of alternative treatment schemes (e.g., precipitation/clarification, ion exchange, biological); conveyance and disposal of metal hydroxide and organic sludges; and plant start-up, operation, and maintenance.

1972 to 1976: Prior to receiving his degrees, Mr. Brausch worked part time as an engineering technician in wastewater treatment design, highway planning, and surveying.

PUBLICATIONS AND PRESENTATIONS

Husak, A. D., L. M. Brausch, and B. P. Bundy, 1985, "Recent Experiences in Waste Site Remedial Action," Symposium Proceedings, American Institute of Chemical Engineers 1985 Spring National Meeting, March 25 through 28, Houston, Texas.

Brausch, L. M. and J. S. Lewis, Jr., 1984, "Case Study: Leachate Containment System Installation, Lipari Landfill, Pitman, New Jersey," Superfund Update: Cleanup Lessons Learned, symposium sponsored by Center for Energy and Environmental Management, May 21 and 22, Denver, Colorado.

Brausch, L. M., 1984, "Advances in Ground Water Treatment Technology," General Electric Environmental Protection Seminar, April 25 through 27, Philadelphia, Pennsylvania.

Brausch, L. M., 1983, "Implementation of Remedial Action Program, Enterprise Avenue Site," Proceedings, Conference on the Disposal of Solid, Liquid, and Hazardous Wastes, American Society of Civil Engineers, April 28 and 29, Bethlehem, Pennsylvania.

Brausch, L. M., 1982, "Siting and Design of Hazardous Waste Landfills," Hazardous Wastes Generation and Management Conference, June 9 and 10, 1982, Pittsburgh, Pennsylvania.

Brausch, L. M., 1982, "Design and Construction of Landfills for Hazardous Wastes," International Conference on Technology and Technology Exchange, May 3 through 6, 1982, Pittsburgh, Pennsylvania.

Hohmann, G. L. and L. M. Brausch, 1981, "Environmental Impact and Protection for the Waste Isolation Pilot Plant (WIPP)," Waste Management '81, American Nuclear Society Topical Meeting, Tuscon, Arizona.

Laushey, L. M. and L. M. Brausch, 1979, "The Geometrics of Rill Formation on Hillsides," Proceedings of the XVIII Congress of the IAHR, International Associated for Hydraulic Research, Caligari, Italy.

Brausch, L. M., 1976, "Observations on Rill Pattern Development," Master's Thesis, University of Cincinnati, Cincinnati, Ohio.

JOHN F. WINTER
VICE PRESIDENT

EDUCATION

M.S., 1963, Civil Engineering, The Ohio State University
B.S., 1961, Mathematics, The Ohio State University

REGISTRATION

Professional Engineer: Florida, Indiana, Michigan, New York, Ohio, Pennsylvania

Licensed Contractor: California, Florida, Louisiana, New Mexico, Utah

PROFESSIONAL EXPERIENCE

1985 to Present: Mr. Winter presently serves as Vice President of Remcor, Inc. in responsible charge of the Field Services Division. Remcor's Field Services Division serves industry by providing planned cleanup of hazardous material contamination problems. Services offered include waste removals, treatment, isolation, decontamination of facilities, ground water treatment, lagoon stabilization, slurry walls, and the construction of hazardous waste disposal facilities. Recent projects performed by the Remcor Field Services Division include numerous polychlorinated biphenyl (PCB) decontamination projects, solidification and disposal of industrial lagoon sludge, cleanup of cyanide plating sludges, tank decontamination, lagoon sludge dewatering, and removal of metals-contaminated soils.

Mr. Winter's Field Services Division also provides a cost estimating service, by which several proposed design alternates may be evaluated for constructibility and cost effectiveness.

1981 to 1985: Mr. Winter served as Field Operations Manager for International Technology Corporation (IT), Pittsburgh, Pennsylvania (formerly D'Appolonia Waste Management Services) responsible for the estimating and management of all field projects in the eastern United States. The types of projects Mr. Winter managed during this time period included: hazardous waste cleanups and removals, ground water treatment, lagoon stabilization, in situ waste isolation, decontamination of facilities, and construction of hazardous waste disposal facilities. Included in these projects were over 16 sites that were listed on the National Priority List for Superfund.

The total dollar value of IT projects managed by Mr. Winter during this time period exceeded $40 million.

1968 to 1981: In 1968 Mr. Winter joined Roger J. Au & Son, Inc. in Mansfield, Ohio. From 1968 until 1973 he was responsible for estimating and office management of major heavy civil underground projects. The majority of these projects were sewer and waterline construction projects. In 1973 he was promoted to the office of Executive Vice President. From 1973 until 1981 he was the officer in charge of all estimating and construction activities. Total annual construction volume reached a peak of $60 million during this period.

The types of projects Mr. Winter managed during this period included power plant site work, concrete foundations and structures, sewers, water lines, tunnels, piling, marine dikes and docks, subaqueous outfalls, dredging, and industrial and muncipal waste disposal.

1963 to 1968: Mr. Winter joined Chapin & Chapin, Inc. of Norwalk, Ohio in 1963 working in field and office construction engineering on large highway and heavy construction projects. These projects included estimating and field management of two large interstate highway projects, a large coal handling facility, two power plant site preparation projects and numerous smaller heavy civil projects.

DEBORAH T. MARSH
PROJECT MANAGER

EDUCATION

M.S., 1979, Civil Engineering, University of Colorado
B.S., 1978, Civil Engineering, University of Colorado

REGISTRATION

Professional Engineer: Ohio, Pennsylvania, West Virginia

PROFESSIONAL EXPERIENCE

1985 to Present: Ms. Marsh is a Project Manager in the Engineering and Project Development Division of Remcor, Inc. She is responsible for developing and managing hazardous waste projects, including:

- Project management for a $2.5 million turnkey remedial investigation/feasibility study (RI/FS) and decontamination of a site contaminated with polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs). Tasks included preparation and execution of a sampling and analysis plan, implementation of a surface water control plan, cleaning demonstrations of building interiors by concrete milling, acid etching, and high-pressure/high-temperature washing, and excavation and removal of "hot spots." The U.S. Environmental Protection Agency (EPA) approved the RI/FS, and the cleanup is expected to be completed shortly.

  In an area of known PCB and PCDD/PCDF contamination, Remcor determined, by analysis of different sample media, that the PCDD/PCDF contamination was, for the most part, associated with a paint layer on wood. From all available data, Remcor developed a relationship between the tetrachlorinated dibenzofuran (TCDF) concentration in a sample to a calculated 2,3,7,8-tetrachlorinated dibenzo-p-dioxin (2,3,7,8-TCDD) equivalence value. This relationship is being used as a screening aid, saving $400 for each analysis.

  Cleanup criteria recommended in the RI/FS were accepted by the EPA and are readily achievable using the methods demonstrated previously at the site.

The cleanup will allow the site to be used for manufacturing or service industries with no continuing threat to human health or the environment.

- Project management of a fast-track preliminary design report evaluating alternatives for upgrading a chemical waste landfill and associated leachate collection basin to meet EPA's minimum technology standards. The study detailed engineering and construction work tasks necessary for implementing each recommended retrofit. Criteria utilized in comparing alternatives included:

  - Cost analysis
  - Technical feasibility
  - Regulatory compliance and implications
  - Impact on Resource Conservation and Recovery Act (RCRA) hazardous waste handling operations
  - Ease of construction.

  The client is using this report as a basis for evaluating options concerning exemption petitioning, construction activities required, and long-term changes in the landfill operating plan.

- Management of a subsurface investigation project designed to identify the lateral and vertical extent of wastes which were placed in a remote area about 27 years ago. These wastes are known to contain TCDD.

- Tracking of RCRA regulations, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Superfund developments, PCB regulations, New Jersey's Environmental Cleanup Responsibility Act regulations, Leaking Underground Storage Tank (LUST) regulations and other developments from the 1984 Hazardous and Solid Waste Amendments, the 1986 Superfund Amendments and Reauthorization Act, as well as other major state developments. Ms. Marsh maintains a resource to provide regulatory interpretation and negotiating strategy.

1984 to 1985: Ms. Marsh served as the Discipline Manager for Regulatory and Permitting projects for International Technology Corporation (IT) in Pittsburgh, Pennsylvania. She directed many projects, ranging from ground water contamination investigations, new facility designs, existing facility double-liner retrofitting projects, and closure plans, to preparing RCRA Part B permit applications for major, complex facilities. She assisted many industrial clients in responding to and negotiating items such as Notices of Deficiency (NOD), consent orders, administrative orders, and other enforcement actions. Some representative experiences include:

- Management of eight RCRA Part B Permit Application projects (and key input to over 20 others) involving plants with only simple container storage to multi-unit plants with landfill(s), surface impoundment(s), incinerator(s), and container and tank storage areas.

- Coordination of the design of two major new hazardous waste landfills to meet the double-liner requirements of the new regulations.

- Preparation of a detailed closure plan for a major industrial client's hazardous waste surface impoundments. This required developing a sampling plan to obtain representative sludge samples, characterizing the sludges, then evaluating several closure alternatives before choosing a stabilization agent and determining a design mix to prepare the sludge for capping.

1979 to 1984: Ms. Marsh served as a Senior Engineer in the Technical Center, Environmental Engineering Department for Union Carbide Corporation (Union Carbide) in South Charleston, West Virginia. She consulted to all Union Carbide chemicals and plastics plants, working mainly in the hazardous waste area, but also reviewed major capital projects for health and environmental concerns, designed a wastewater treatment facility for an acrylics manufacturing unit, and served on a National Pollution Discharge Eliminaion System (NPDES) team to negotiate a discharge permit for a major chemical plant. Ms. Marsh reviewed RCRA regulations for impact on Union Carbide's facilities and commented on the regulations for Chemical Manufacturer Association committees. She helped plants comply with the early ground water monitoring requirements by choosing well locations and depths and/or preparing sampling and analysis plans. Ms. Marsh also prepared RCRA documents for several facilities; ground water quality assessment plans, RCRA Part B Permit Applications, and closure plans are examples.

She managed several ground water contamination investigations, including deciding well locations, supervising drilling, developing analytical programs, and assessing and reporting results. These investigations were triggered by Superfund, RCRA imminent hazard concerns, or by RCRA Interim-Status Ground Water Quality Assessment Plan requirements.

Ms. Marsh developed solid and hazardous waste checklists for Union Carbide's internal environmental audit program, then coordinated and led several audits at different facilities. Some audits were specifically investigating hazardous waste activities; others were comprehensive and included good housekeeping practices in addition to regulatory requirements for air, water, and solids.

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers
National Water Well Association
Water Pollution Control Federation
Chi Epsilon
Tau Beta Pi
Hazardous Materials Control Research Institute

PUBLICATIONS AND PRESENTATIONS

Marsh D. T. and H. E. Thomson, Jr., 1986, "Small Quantity Generator Requirements with Emphasis on Used Oil Recycling," presented at The Equipment Service Association Conference, Las Vegas, Nevada, May 10, 1986.

Marsh, D. T., 1985, "Toxic Substances Control Act,"; "RCRA Basic Provisions,"; "RCRA Permit Process," Training Seminar on Environmental Regulations, presented to E. I. DuPont DeNemours and Company, Savannah River Plant, Aiken, South Carolina, June 20-21, 1985.

Marsh, D. T., L. Benefield, E. Bennett, D. Linstedt, D. Smith, and R. Hartman, 1981, "The Coupled Trickling Filter-Rotating Biological Contactor Nitrification Process: Design Considerations," Journal Water Pollution Control Federation.

Marsh, D. T., 1979, "The Coupled Trickling Filter-Rotating Biological Contactor Nitrification Process: Design Considerations," Water Pollution Control Federation Conference, Houston, Texas.

Marsh, D. T., 1979, "The Coupled Trickling Filter-Rotating Biological Contactor Nitrification Process: Design Considerations," Master's Thesis, University of Colorado, Boulder, Colorado.

WILLIAM E. ROSENBAUM
PROJECT MANAGER

EDUCATION

M.S., 1983, Business Administration, Robert Morris College
B.S., 1974, Civil Engineering, University of Notre Dame

REGISTRATION

Professional Engineer: Pennsylvania

Certified Sewage Treatment Plant Operator: Pennsylvania

Certified Waterworks Operator: Pennsylvania

PROFESSIONAL EXPERIENCE

1987: Mr. Rosenbaum has recently joined Remcor, Inc. as a Project Manager in the Engineering Group. His responsibilities include project management and key technical contributions related to remedial action design. His project experience at Remcor includes:

- Design of modifications to the closure of a series of hazardous waste holding lagoons to optimize the design, reduce construction costs, and expedite completion of the closure.
- Development of a work plan for the site stabilization of a former metals processing facility. The site was contaminated with radioactive thorium and heavy metals.

1981 to 1987: Mr. Rosenbaum served as a Senior Engineer and Assistant Engineering Manager responsible for the Environmental Design Group of Baker/TSA Inc. As Assistant Engineering Manager, he managed a group of 18 engineers and technicians and was responsible for the following:

- Technical quality control.
- Personnel performance reviews.
- Preparation of proposals.
- Budgetary control of design projects.

His major project experience at Baker/TSA Inc. included the following:

- Project Manager for grading and capping of a hazardous waste landfill in New Jersey. The project included regrading, installation of waterways, leachate collection system, gas vents, and low permeability soil cap. Total construction cost of the grading and capping project was $4.5 million.

- Design Manager for the preparation of plans, specifications, operations and permitting for radiological contamination removal in Essex County, New Jersey. Project budget was $12 million and required the preparation of detailed plans and specifications in six weeks. The project included contracts for construction, transportation and disposal and involved resident relocation, radiological health and safety procedures, public relations and utility coordination.

- Project engineer for the preparation of plans and specifications for the closure of a hazardous waste landfill owned and operated by a major steel company. The project included regrading, installation of a clay cap, leachate and runoff piping.

- Project engineer for the preparation of plans and specifications for the design of a fly ash disposal landfill located on the banks of the Ohio River.

- Developed, for a major steel corporation, portions of a Comprehensive Hazardous Waste Management Plan dealing with wastewater treatment, storage and disposal. The plan reviewed options and developed alternatives to economically comply with hazardous waste and NPDES regulations. Alternatives reviewed included recycle/reuse, operations and process modifications and waste reduction measures.

- Designed and supervised preparation of drawings and specifications for a wastewater treatment facility to store and treat runoff from a 35-acre coal handling facility in Ashtabula, Ohio. The project included an equalization lagoon constructed at lake level using slurry wall technology.

1977 to 1981: Mr. Rosenbaum served as a Process Project Engineer for The Chester Engineers, Inc., Coraopolis, Pennsylvania, where his duties included the following:

- Supervising facility design projects for various industries, including the design and construction of hazardous waste handling facilities in compliance with Resource Conservation and Recovery Act (RCRA) requirements.

- Obtaining permits from state and federal agencies.

- Preparation of itemized construction cost estimates and in-house construction supervision.

Following is a summary of Mr. Rosenbaum's major project experience:

- Designed and provided general inspection services for the construction of a double lined hazardous waste holding lagoon for a major electronics manufacturer. The facility included two one-million gallon compartments each equipped with a double liner with intermediate leak detection and collection system. All piping to and from the facility was installed in a casing pipe with a separate leak collection system.

- Project manager for the $5million addition to the wastewater treatment facility owned by a heavy equipment manufacturer in Illinois. The project included API separation, clarification, thickening, vacuum filtration, shallow bed sand filtration and chrome treatment.

- Lead project engineer for the design of additions to an existing treatment facility owned by a manufacturer of electronic components. The system, designed for the treatment of ion exchange spent regenerate, including softening, reverse osmosis and double lined solar evaporation ponds.

- Lead project engineer for the design of a batch treatment system to remove arsenic and selenium from rinse waters generated in the manufacture of copy equipment. The system was designed around a process utilizing activated alumina.

1976 to 1977: Mr. Rosenbaum served as a Resident Engineer for Black and Veatch Consulting Engineers. His responsiblities included construction supervision for the purpose of assuring compliance with plans and specifications and surveying.

1974 to 1976: Mr. Rosenbaum served with U.S. Air Force, 351st Strategic Missle Wing as a Missle Launch Officer.

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers
American Water Works Association
Water Pollution Control Federation

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JOHN A. GEORGE
SENIOR SCIENTIST

EDUCATION

M.S., 1976, Terrestrial Ecology, Clarion University of Pennsylvania

B.S., 1975, Biology, Clarion University of Pennsylvania

PROFESSIONAL EXPERIENCE

1987: Mr. George recently joined Remcor, Inc. as a Senior Scientist in the Engineering Group. In this position he is responsible for schedule, budgetary development and control, and technical oversight of projects relative to site characterization and remedial alternative evaluation.

He is presently managing a study of volatile organic ground water contamination at an industrial site near Allentown, Pennsylvania, and is participating in a study of the U.S. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) Corrective Action Program on the domestic steel industry.

1982 to 1987: Mr. George served as a Project Manager in the Waste Management Services Division of NUS Corporation in Pittsburgh, Pennsylvania. During much of this period NUS was the prime contractor to the EPA for Remedial Planning and Field Investigation Team (FIT) support for the Superfund Program. Mr. George participated in several Remedial Investigation/Feasibility Studies (RI/FS) at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, both technically and in a managerial role. The following provides a representative listing of project experience:

- Groveland Wells Site, Groveland, Massachusetts

  Project Manager - RI/FS for 820-acre municipal wellfield in northeastern Massachusetts contaminated with volatile organics, principally trichloroethylene (TCE)

- Charles George Land Reclamation Trust Landfill Site, Tyngsboro, Massachusetts

  Project Manager - RI/FS for 70-acre municipal and industrial waste landfill in northeastern Massachusetts overlying contaminated fractured bedrock aquifer tapped by domestic wells; total landfill volume approximately four million cubic yards.

- Cannon Engineering/Plymouth Site, Plymouth, Massachusetts

  Technical Lead - Wetlands and Floodplain Assessment in support of Feasibility Study.

- Drake Chemical Site, Lock Haven, Pennsylvania

  Technical Lead - Assessment of vegetative stress due to discharge of herbicides from a former manufacturing facility.

- Sullivan's Ledge Site, New Bedford, Massachusetts

  Project Manager - RI/FS for volatile organic/PCB/ metals disposal in abandoned quarry pits.

- Leetown Pesticide Site, Leetown, West Virginia

  Project Manager - RI/FS for evaluation of 2.5-square mile watershed contaminated through indiscriminant disposal of pesticides and the use of agrichemicals.

- Leetown Pesticide Site, Leetown. West Virginia

  Project Manager - Bench Scale Treatability Study of Microbial Degradation of Pesticides by Indigenous Soil Microbes

<u>1980 to 1982</u>: Mr. George served as Director of Mining Services with Penn Environmental Consultants (acquired by NUS Corporation in 1981), supervising a staff that provided complete engineering and permitting services to several moderate-sized Appalachian surface mining interests.

<u>1979-1980</u>: Mr. George served as a principal investigator with Michael Baker Corporation, Beaver, Pennsylvania. His responsibilities involved environmental assessments for utility line construction and development of environmental baseline data for mining operations.

<u>1977-1979</u>: Mr. George served as Supervisor of the Land Stabilization and Reclamation Program (Surface Mining Reclamation) at Belmont Technical College, St. Clairsville, Ohio.

PREVIOUS PROFESSIONAL AFFILIATIONS

American Chemistry Society
American Institute of Biological Sciences
Pennsylvania Mining Professionals (Vice President, 1981/1982)
Soil Conservation Society of America

PUBLICATIONS

Hubbard, A. E., J. A. George, R. Hubbard, and W. Hagel, 1986, "Quantitative Risk Assessment as the Basis for Definition of Extent of Remedial Action at the Leetown Pesticide Superfund Site," Presented at the HMCRI Superfund '86 Conference, Washington, DC.

George, J. A., 1982, "Erosion and Sedimentation Control Alternatives - Surface Mining in Northern Appalachia," presented at the Fifth Annual Meeting of the Water Pollution Control Association of Pennsylvania, Pittsburgh, Pennsylvania.

George, J. A., 1976, <u>Seasonal Weight and Activity Relationships in a Free-Ranging Population of the Eastern Chipmunk (Tamias striatus) Rodentia: Sciuridae</u>, Master's Thesis, Clarion State College.

LINDA K. SCHOLL
SENIOR SCIENTIST

EDUCATION

B.S., 1974, Medical Science, Alderson-Broaddus College
Graduate Study: Industrial Hygiene and Environmental Science, West Virginia College of Graduate Studies

PROFESSIONAL EXPERIENCE

1986 to Present: Ms. Scholl is Senior Scientist in the Engineering and Project Development Division of Remcor, Inc. She is responsible for the development and implementation of environmental and occupational health projects at Remcor, including:

- Administrative responsibility for Remcor corporate health and safety
- Development and implementation of project health and safety plans and training of site personnel
- Performing health, safety, and industrial hygiene audits at remedial sites and manufacturing facilities
- Development of Endangerment Assessments for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites
- Development of Alternate Concentration Limits demonstrations for Resource Conservation and Recovery Act (RCRA) Part B permit applications
- Development of health-based clean-up criteria for remediation of hazardous waste sites.

1976 to 1986: Ms. Scholl served as Senior Engineer in the Health, Safety and Environmental Services in the Environmental Engineering and Research and Development Departments for Union Carbide Corporation (Union Carbide) in South Charleston, West Virginia. She consulted to all Union Carbide chemicals and plastics plants, working mainly in the hazardous waste, occupational health, and air quality control areas. She also worked two years in analytical research for Union Carbide's central Research and Development Department.

In Environmental Engineering, Ms. Scholl performed health risk assessments for a variety of sites, including CERCLA Endangerment Assessments for inactive disposal sites and contaminated facilities and the development of Alternate Concentration Limits for RCRA Part B permit applications. She also developed health-based clean-up criteria for site remedial activities. Ms. Scholl served as Health and Safety Officer for field investigations with responsibility for employee training, development of health and safety plans, and site audits.

Ms. Scholl spent three years in Union Carbide's Industrial Hygiene Research and Development group where she was responsible for the development and statistical validation of industrial hygiene sampling and analytical methods. Ms. Scholl was instrumental in the development of an industrial hygiene sampling strategy for use in Union Carbide manufacturing facilities. She also conducted industrial hygiene seminars and training sessions and managed a chemical hazards data base for use in the Occupational Safety and Health Administration (OSHA) hazard communications compliance activities for all Union Carbide sites and developed health hazard ratings for organic chemicals. She was guest lecturer for the West Virginia College of Graduate Studies and Marshall University in Industrial Hygiene.

Ms. Scholl performed air quality sampling for several Union Carbide locations, including stack sampling, ambient air surveys, fugitive emissions studies, and sampling for odor assessment studies. She also developed sampling and analytical methods for ambient air surveys. She performed hazardous waste characterization studies and thermal decomposition studies.

Ms. Scholl was involved in a variety of environmental health audit functions, including hazardous waste disposal auditor for Union Carbide's technical center at South Charleston, health specialist for operational health and safety surveys at manufacturing locations, and field audits at remedial sites.

She has experience in analytical chemistry and quality assurance/quality control, primarily with infrared, ultraviolet, and nuclear magnetic resonance spectroscopy and with gas and liquid chromatography.

1974 to 1975: Ms. Scholl was a Physician's Assistant with responsibility for medical histories and physical exams, surgical assistance, emergency medical care, patient counseling, and preliminary diagnostic evaluation. She was certified by the American Board of Medical Examiners and was also a member of the American Academy of Physician's Assistants.

PROFESSIONAL AFFILIATIONS

Air Pollution Control Association
American Industrial Hygiene Association
Hazardous Materials Control Research Institute

PUBLICATIONS AND PRESENTATIONS

Scholl, L. K., 1985, "The Role of the Industrial Hygienist in Hazardous Waste Site Investigations," American Industrial Hygiene Association Conference, Las Vegas, Nevada, May.

Wilkes, B. E., L. K. Scholl, and L. J. Priestley, "An Improved Thermal Desorption GC/MS Method for the Determination of Chloromethane in Ambient Air", Microchemical Journal, September 27, 1982.

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JOSEPH G. KASPER
PROJECT GEOLOGIST

EDUCATION

B.S., 1980, Geology, West Virginia University

PROFESSIONAL EXPERIENCE

1986 To Present: Mr. Kasper presently serves as a Project Geologist for Remcor, Inc. in responsible charge of developing and implementing ground water monitoring programs, including leaking underground storage tanks, Environmental Cleanup Responsibility Act (ECRA) studies, Resource Conservation and Recovery Act (RCRA) programs, and remedial investigations. Specific duties include:

- Managing a ground water monitoring program for a Remedial Investigation/Feasibility Study (RI/FS) of a closed landfill containing industrial and polychlorinated biphenyl (PCB) wastes. The landfill was characterized by a 1:1 slope with a multi-aquifer ground water flow system.

- Implementation of an Environmental Conservation and Recovery Act (ECRA) study of an industrial facility characterized by leaking underground storage tanks and a high water table. Duties included monitoring well installation and sampling, determining extent of contamination, and report preparation.

- Conducting a subsurface investigation of volatile organic contamination of a solvent storage area utilizing volatile organic screening techniques.

- Supervision of a Resource Conservation and Recovery Act (RCRA) study of a closed landfill containing metal sludges. The program included monitoring well installation in alluvial deposits, waste sampling and delineation, and stream characterization.

- Development of remedial alternatives for a feasibility study of a closed hazardous waste landfill utilizing waste isolation and ground water control technologies.

- Responsible for the development and preparation of technical reports and proposals pertaining to subsurface investigations and ground water monitoring.

1982 to 1986: Mr. Kasper served as a Hydrogeologist Site Manager for NUS Corporation, Pittsburgh, Pennsylvania, developing and supervising ground water investigations at uncontrolled hazardous waste sites and industrial facilities. Duties included: identification of water-bearing zones; supervision of monitoring well installation in consolidated/ unconsolidated formations; conducting aquifer permeability and dye tracer tests; interpreting borehole geophysical logs; and writing remedial investigation reports describing geology, ground water flow, and water quality data. As a Geologist, he conducted field investigations for RCRA ground water monitoring programs, developed drilling specifications for Superfund projects, prepared written proposals, wrote geology-hydrogeology sections of Remedial Action Master Plans and Work Plans for hazardous waste sites.

1981 to 1982: Mr. Kasper served as a Coal Exploration Geologist for United States Steel Corporation, conducting active coal exploration on various Eastern United States drilling programs. Duties included: technical report writing; construction of isopach maps; interpretation of borehole geophysical logs; logging core exploration holes; and depositional analysis of target coal seams.

AFFILIATION

National Water Well Association

TRAINING

Successfully completed NUS sponsored technical writing seminar (April 1984)

Successfully completed Superfund Training Course (February 1983) and Basic Field Instrumentation Course (June 1983) on use of air monitoring equipment (hnu, OVA, Photovac)

Attended short course sponsored by Pittsburgh Geological Society on the use of borehole geophysics in ground water investigations (May 1983)

CARY B. JACKSON
3249 SILVERTHORNE DRIVE
FORT COLLINS, COLORADO 80526
303/226-3561

Professional Background

Mr. Cary B. Jackson has over 12 years of professional experience in the water, wastewater, and hazardous waste field. Nine of the years have been in a project management and supervisory role. After receiving an undergraduate degree in chemistry, Mr. Jackson began working at an 18 MGD sewage treatment facility. There he learned the basic operations of primary and secondary treatment and applied principles of chemistry to the treatment of sewage. Additionally, Mr. Jackson evaluated several different types of bio-disc filtration systems for optimal biological oxygen demand reduction, and aided in the investigation of industrial discharge violators.

Later Mr. Jackson became a fundamental research chemist in water and wastewater research for a Fortune 500 company. There Mr. Jackson evaluated different processes for developing high purity drinking water systems employing reverse osmosis, deionization, ultrafiltration, carbon adsorption, ozonation, and ultra-violet radiation. Mr. Jackson also studied mechanisms of trihalomethane formation in water and wastewater. Under contract to the U.S. Environmental Protection Agency (EPA), Mr. Jackson participated in the characterization of influents and effluents from chemical and process manufacturer discharges. This characterization was used in conjunction with the National Water Quality Survey and was the first phase of a three-phase study for national discharge regulations from industry and publicly owned treatment works.

While managing the organic section of a large wastewater laboratory for an engineering firm, Mr. Jackson evaluated different types of carbon adsorption systems for the removal of trihalomethanes and managed a multimillion dollar analytical/engineering effort for characterizing industrial and combined process wastewaters derived from product process of organic and synthetic plastic chemical manufacturers. Further, Mr. Jackson evaluated sludges for treatment and disposal. While working there, Mr. Jackson became well known and recognized for his accomplishments in the water and wastewater field.

In 1980, Mr. Jackson became an independent consultant providing services to the EPA in reviewing Best Available Treatment and Technology data and to engineering firms and wastewater laboratories in feasibility studies, analysis and laboratory management.

In 1982, Mr. Jackson left his private consulting practice to manage, under contract to an engineering firm, a hazardous waste research facility for the EPA. During this time, Mr. Jackson managed up to 20 chemists and technicians in the analysis of hazardous waste. Additionally, Mr.

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Jackson edited the High Hazard Analysis Protocol for the EPA and co-designed the high hazard laboratories for the Center for Disease Control in Atlanta, Georgia and the EPA A.W. Breidenbach Environmental Research Center in Cincinnati, Ohio.

In 1984, Mr. Jackson returned to private consulting, incorporating his practice, known as Support Systems Inc.

From 1984 to October 1986, Mr. Jackson was retained by a large engineering firm and a corporation involved in the acquisition of environmental laboratories to reorganize laboratory operations and to hire and train laboratory personnel. Both of these tasks resulted in successful curing of EPA action notices against the two firms.

Additionally, Mr. Jackson, through Support Systems Inc., has been awarded subcontractors to provide data review of EPA Contract Laboratory Program analytical results.

Areas of Expertise

High Purity Water Systems
Wastewater Process Treatment Characterization and Evaluation
Drinking Water Systems
Program and Project Management
Gas Chromatography
Mass Spectrometry
Laboratory Design
Laboratory Management
Quality Assurance
Pollutant Analysis
Sample Analysis Data Management Systems
PC Computers

Education

Bachelor of Arts, Chemistry, University of Northern Colorado, 1974
Graduate Courses, Chemistry, University of California, 1976
Graduate Courses, Business, University of Northern Colorado, present
Continuing Education Course, Supervision and Management by Objectives, 1979
Continuing Education Course, Laboratory Design and Laboratory Ventilation, 1983

Memberships

Past member and exhibitor, Federal Water Pollution Control Federation
Past member, American Water Works Association
Past member, California Water Pollution Control Federation
Present member, Environmental Protection Agency's Organic Caucus Group

Publications and Presentations

Jackson, C., Pavlick, R., Scholtz, H., Rushneck, D., Analytical Problem Solving, J. Environ. Sci. and Health, A15(5), 1980.

Taylor, J., Jackson, C., Miller, M., Rushneck, D., Laboratory Management, J. Environ. Sci. and Health, A15(51), 1980.

Jackson, C., Interference Reduction Options, presented to the U.S. Environmental Protection Agency's Best Available Technology conference, Dallas, Texas, 1979.

Proceedings of the Southwest Geochemistry Conference, Tulsa, Oklahoma, April 1983.

Presented a paper for the U.S. Environmental Protection Agency on review of Effluent Guidelines, Rocky Mountain Analytical Conference, July 1985.

Chairs

U.S. Environmental Protection Agency's Organic Caucus Group Meeting, Las Vegas, Nevada, 1984.

Lecturer

California Water Pollution Control Association, Priority Pollutants, San Diego, California, 1979.

Minnesota Chromatography Forum, two-day course on laboratory design, management, analysis and quality assurance, Minneapolis, Minnesota, 1986.